Chambers's Practical Concentric Arithmetics

By

A HEAD TEACHER

With Original Ideas and Wide Practical Experience

Edited by

W. WOODBURN

Author of Chambers's 'Thorough Arithmetics'

BOOK IV

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SPECIAL FEATURES OF THE SERIES.

(1) Doing precedes figuring throughout.

(2) Things come before figures. There is something to calculate before any attempt is made to teach the use of symbols.

(3) Rules are deduced from actual experiment and observation.

(4) Visualisation is the basis of all the teaching.

(5) Number, so far as possible, arises from data within the child's experience.

(6) No abstract quantities are dealt with until number notions have been thoroughly fixed.

(7) Examples are worked in a realistic manner before any symbols are used.

(8) Geometry is introduced at an early stage.

(9) 'The teaching is concerned with elementary notions of form,' and is therefore 'applied and concrete arithmetic rather than abstract arithmetic' ('Revised Suggestions').

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Book IV.

Exercise 1.—Notation beyond 100000—with Revision.

(1) Write in words the following numbers: 37694, 50058, 120006, 360089, 189295. Find their sum.

(2) In 1912 the population of a city was 239639. In 1913 it was 243638. What was the increase?

(3) One August a newspaper said: 'There are 60000 visitors in the Isle of Man.' If the visitors paid on an average 6s. 0d. for fares, how much did they pay altogether?

(4) A farmer has 100 acres of land sown with peas. If he gathers 65 bags of peas from every acre, and each bag contains 56 lb., how many lb. of peas does he get?

(5) A hamper holds 59 lb. of plums. How many hampers are required for 87084 lb.?

(6) In a week 250609 people go to an exhibition. If the admission is 6d. each, how much is taken?

(7) In a dairy there are 4694 lb. of cheese. If it is sold at 10d. per lb., how much is received for it?

(8) On Bank Holiday the trams of a city took £489, 4s. 10d. If the fare was 1d. per stage, how many fares were paid?

(9) A bank received £10 worth of new pennies and £10 worth of new halfpennies. How many coins were received?

(10) A French fruit merchant lost 25000 francs through a railway strike. If a franc is worth 9½d., how much did he lose in British money?

(11) Potatoes are sold at £3, 12s. 8d. per ton. What is the value of 13 trucks of potatoes, each holding 7 tons?

(12) £428, 12s. 4½d. is paid by ninety-seven persons for a sea trip. How much is that each?

(13) How often can a man spend 3s. 4d. out of £20?

(14) Potatoes are 8d. per stone. How many stones can be bought for £7, 10s. 0d.?

(15) Make up and work a sum about a boy going for a holiday with £5.

14 627

Exercise 2.—Notation beyond 100000—with Revision.

(1) Write the following numbers in words: 398064, 568607, 406006, 298706, 904087. (*a*) Add them together; (*b*) take the least number from the greatest.

(2) A football playing-area is 180 yards long and 80 yards wide. What does it cost to return it at 6d. per sq. yd.?

(3) The admission to a cricket match was 6d. If the takings were £84, 10s. 6d., how many persons went to the match?

(4) It took 15 inches of string to tie up a sack. How many yards would be needed to tie up 516 similar sacks?

(5) A farmer had £87, 18s. 9d. in the bank. He sold 11 cows at 19 guineas each, and a stack of hay for 30 guineas. How much money had he then?

(6) 15 lb. of tea at 1s. 8d. per lb. are mixed with 37 lb. at 2s. 4d. per lb. How much is the whole mixture worth?

(7) How many lb. of coffee at 1s. $7\frac{1}{2}$d. per lb. can be bought for £2, 3s. $10\frac{1}{2}$d.?

(8) Write down the answers to the following sums: (*a*) 1 dozen books at $7\frac{1}{2}$d. each; (*b*) 1 dozen lb. of tea at 1s. $9\frac{1}{2}$d. per lb.; (*c*) 18 yards of cloth at 2s. $11\frac{3}{4}$d. per yard.

(9) What is the amount of the following bill: 1 gross of oranges at $4\frac{1}{2}$d. per dozen; 54 lemons at 1s. 4d. per dozen; 47 lb. of apples at $3\frac{1}{2}$d. per lb.; 16 stones of potatoes at 8d. per stone; 18 cabbages at $2\frac{1}{2}$d. each?

(10) Wheat is 18s. 9d. per sack, and oats 16s. 8d. per sack. How much do 57 sacks of each cost?

(11) A boy had x pounds. How many shillings had he?

(12) Write 3645 millimetres in as many ways as you can.

(13) Concrete flags are 2 feet square. How many are required to make a causeway 168 feet long and 9 feet wide?

(14) Eggs are 10 for 1s. How many could a merchant buy for £7, 15s. 0d.?

(15) A party of 35 persons hire a motor char-à-banc for £11, 13s. 4d. How much should each pay?

(16) A greengrocer bought 900 oranges at 15 for 1s. He sold them at 1d. each. What did he gain?

(17) Divide £77, 11s. 9d. into thirty-seven equal parts.

(18) Make up and work a sum about a man spending £5 on clothes.

(1) How many inches in (*a*) 14 yd. 2 ft. 9 in.? (*b*) 25 yd. 1 ft. 8 in.? (*c*) 35 yd. 2 ft. 6 in.? (*d*) 78 yd. 11 in.?

(2) How many inches in (*a*) 3 ch. 10 yd. 2 ft.? (*b*) 12 ch. 15 yd. 1 ft.? (*c*) 2 fur. 24 yd. 1 ft.? (*d*) 3 fur. 5 ch. 14 yd.?

(3) How many inches in (*a*) 5 fur. 36 yd. 2 ft. 3 in.? (*b*) 7 fur. 34 yd. 1 ft. 9 in.? (*c*) 6 fur. 80 yd. 2 ft.?

(4) How many yd., ft., and in. are there in (*a*) 346 in.? (*b*) 849 in.? (*c*) 1086 in.? (*d*) 2437 in.?

(5) Reduce 3467 inches to chains; 15467 inches to furlongs; 6469 inches to chains; 8675 yards to miles.

(6) A pin is 1 inch long. How many yards of wire are required for one hundred thousand pins?

(7) A motor-car wheel is 7 feet round, and it turns 175 times per minute. How many yards does it go in a minute?

(8) How many half-inch nails can be made from 3 ch. 20 yd. of wire?

(9) A wall is 348 bricks long. How many yards long is the wall if each brick measures 9 inches?

(10) A lane is 68 ch. 16 yd. long, and another is 74 ch. 12 yd. long. How many feet is one longer than the other?

(11) One side of an oblong field measures 3 fur. 150 yd., and another side is 1 fur. 64 yd. How many yards is it round the field?

(12) A bicycle-wheel is 8 feet in circumference, and turns round 1560 times in going from school to home. How far is it from home to school? (*Answer in chains and yards.*)

(13) A man takes a step a yard long. How many steps does he take in going 3 miles 840 yards?

(14) The length of a boy's step is 2 feet. How many steps does he take in going 4 fur. 68 yd.?

(15) An ironmonger orders 3 gross of pokers, 18 inches long. How many yards of bar-iron are used in making them?

(16) Make up a sum about the distance from home to school.

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(17) A quotient is 148, the remainder is 29, and the divisor is 47. What is the dividend?

(18) £137, 10s. 0d. was spent on wool at 2s. 3½d. per lb. How many lb. were bought?

Exercise 4.—Long Measure—Addition and Subtraction.

(1) A joiner receives boards the following lengths: 6 yd. 2 ft. 9 in., 4 yd. 1 ft. 10 in., 5 yd. 2 ft. 7 in., 7 yd. 1 ft. 9 in., 3 yd. 2 ft. 8 in., and 8 yd. 1 ft. 10 in. What is the total length of the boards?

(2) The sides of a field are the following lengths: 12 ch. 18 yd. 2 ft., 16 ch. 19 yd. 2 ft., 27 ch. 12 yd. 1 ft., and 14 ch. 12 yd. 2 ft. What is the distance round the field?

(3) The sides of a park measure 6 fur. 9 ch. 21 yd., 4 fur. 6 ch. 9 yd., 7 fur. 6 ch. 18 yd. 2 ft., and 5 fur. 5 ch. 5 yd. What is the total length of the boundary wall?

(4) A man had to make a fence 36 yd. 1 ft. 6 in. long. He had rails for only 18 yd. 1 ft. 9 in. For what length had he not rails?

(5) A lane is 7 fur. 8 ch. 12 yd. long. If 3 fur. 8 ch. 19 yd. is in one parish, and the remainder in the next, what length is in the second parish?

(6) A draper had 4 pieces of calico the following lengths: 12 yd. 18 in.; 10 yd. 1 ft. 6 in.; 14 yd. 15 in.; 7 yd. 2 ft. He sold altogether 25 yd. 1 ft. How much had he then?

(7) An irregularly shaped field measures 8 ch. 9 yd. 1 ft., 6 ch. 17 yd. 1 ft., 4 ch. 16 yd. 2 ft., and 7 ch. 19 yd. 1 ft. What is the distance all round the field?

(8) A draper bought 2 pieces of cotton—one measuring 28 yd. 1 ft. 6 in., and the other 34 yd. 2 ft. What remained after he had sold 36 yd. 1 ft. 9 in.?

(9) One side of an oblong recreation ground measures 3 fur. 3 ch. 14 yd., and another side measures 2 fur. 8 ch. 18 yd. What is the distance round it?

(10) Four pieces of cloth are the following lengths: 20 yd. 2 ft. 10 in.; 28 yd. 1 ft. 6 in.; 34 yd. 1 ft. 5 in.; and 18 yd. 8 in. Find the total length of the four pieces.

(11) A boy has 3 fur. 4 ch. 18 yd. of string for his kite. If the kite is 2166 feet away from him, how many yards of string are there on his reel?

(12) Make up a sum about a joiner buying boards, and work it.

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(13) What is left after sharing £250 equally among 46 men?

(14) What is the cost of 18 trucks of coal, each containing $9\frac{1}{2}$ tons, at £1, 1s. 6d. per ton?

Exercise 5.—Long Measure—Multiplication and Division.

(1) A roll of wire measures 24 yd. 2 ft. 9 in. Find the length of 15 similar rolls.

(2) A boy lives 5 fur. 6 ch. 14 yd. from school. How far does he walk in going to and from school twice a day?

(3) What is the total length of 12 pieces of cloth, each measuring 25 yd. 2 ft. 9 in.?

(4) 35 girls in a class make a similar garment each. If one garment requires 1 yd. 2 ft. 5 in. of calico, what is the total length of calico used?

(5) One boy lives 1 m. 2 fur. 6 ch. from school, and another 7 fur. 6 ch. 18 yd. How much farther does one boy walk than the other in a week in going to and from school if each goes twice a day?

(6) The furrow made by a plough is 5 fur. 6 ch. 8 yd. long. What distance has a man walked when he has ploughed 28 such furrows?

(7) A boy walked 3 m. 2 fur. 9 ch. in an hour. How far did he walk in 15 minutes?

(8) 36 telegraph poles have a total length of 8 ch. 7 yd. If they are all the same length, how long is each?

(9) In going from home to the workshop and back again, a man travelled 15 m. 2 fur. 6 ch. in 4 days. How far was the workshop from his house?

(10) A garden-plot is 22 yd. 2 ft. long, and 18 yd. 1 ft. wide. It is fenced round with tiles, each 6 inches long. How many tiles are required?

(11) (*a*) 6 ch. 13 yd. 1 ft. 4 in.÷34; (*b*) 9 ch. 10 yd. 2 ft. 3 in.÷45; (*c*) 10 fur. 1 ch. 15 yd. 2 ft.÷61; (*d*) 27 fur. 7 ch. 4 yd. 2 ft.÷59.

(12) A merchant buys 1 gross of tape measures, each 66 feet long. How many furlongs will all the tapes measure?

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(13) A mill uses 398 gallons of water every day for 313 days. How many gallons are used altogether?

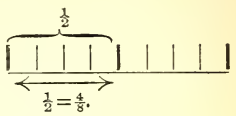
(14) £67, 1s. 7d. is divided equally among 34 persons. How much does each get?

(15) How much do I save in 2 years, at 17s. 10d. a week?

(16) Make up a sum about going for a walk.

Exercise 6.—Fractions—Addition and Subtraction.

(1) Show by drawing lines (as in diagram) that (*a*) $\frac{1}{2}=\frac{2}{4}$; (*b*) $\frac{1}{2}=\frac{4}{8}$; (*c*) $\frac{1}{3}=\frac{2}{6}$; (*d*) $\frac{1}{3}=\frac{3}{9}$; (*e*) $\frac{1}{5}=\frac{2}{10}$:



(2) Draw an oblong to show that $\frac{3}{4}=\frac{6}{8}$, and another oblong to show that $\frac{8}{24}=\frac{1}{3}$.

(3) Write down the value of the following fractions in another way: $\frac{2}{4}$ in., $\frac{2}{6}$ in., $\frac{6}{8}$ in., $\frac{4}{10}$ in., $\frac{8}{12}$ in., $\frac{6}{16}$ in., $\frac{8}{20}$ in., $\frac{6}{24}$ in.

(4) Write down the value of x in the following:

(*a*) $\frac{1}{3}$ in. $=\frac{x}{6}$ in.; (*b*) $\frac{3}{4}$ in. $=\frac{6}{x}$ in.; (*c*) $\frac{2}{5}$ in. $=\frac{x}{20}$ in.;
(*d*) $\frac{3}{x}$ in. $=\frac{15}{20}$ in.; (*e*) $\frac{x}{6}$ in. $=\frac{3}{18}$ in.; (*f*) $\frac{1}{9}$ in. $=\frac{3}{x}$ in.

(5) Draw lines to show how many tenths there are in: (*a*) $1\frac{1}{2}$ in.; (*b*) $2\frac{1}{5}$ in.; (*c*) $3\frac{4}{5}$ in.; (*d*) $4\frac{7}{10}$ in

(6) With coloured strips of paper or lines work the following:

(*a*) $\frac{1}{2}$ in. $+\frac{3}{4}$ in.; (*b*) $\frac{3}{4}$ in. $+\frac{5}{8}$ in.; (*c*) $\frac{2}{3}$ in. $+\frac{5}{6}$ in.;
(*d*) $\frac{3}{5}$ in. $+\frac{7}{10}$ in.; (*e*) $1\frac{1}{4}$ in. $+1\frac{3}{8}$ in.; (*f*) $1\frac{1}{3}$ in. $+1\frac{3}{5}$ in.

(7) Work, by using lines or two different colours of paper:

(*a*) $\frac{3}{4}$ in. $-\frac{1}{2}$ in.; (*b*) $\frac{5}{8}$ in. $-\frac{1}{2}$ in.; (*c*) $\frac{5}{6}$ in. $-\frac{2}{3}$ in.;
(*d*) $\frac{7}{10}$ in. $-\frac{2}{5}$ in.; (*e*) $1\frac{1}{4}$ in. $-\frac{5}{8}$ in.; (*f*) $1\frac{1}{3}$ in. $-\frac{5}{6}$ in.

(8) With coloured paper or lines work the following sums:

(*a*) $2\frac{1}{4}$ in. $+1\frac{3}{8}$ in.; (*b*) $1\frac{1}{3}$ in. $+2\frac{1}{6}$ in.; (*c*) $1\frac{3}{5}$ in. $+2\frac{3}{10}$ in.;
(*d*) $2\frac{1}{2}$ in. $-1\frac{3}{8}$ in.; (*e*) $1\frac{1}{2}$ in. $-\frac{5}{6}$ in.; (*f*) $2\frac{1}{5}$ in. $-\frac{9}{10}$ in.

(9) Work the following sums by using oblongs:

(*a*) $\frac{1}{4}+\frac{3}{8}$; (*b*) $\frac{2}{3}-\frac{3}{6}$; (*c*) $\frac{2}{5}+\frac{3}{10}$; (*d*) $\frac{5}{8}-\frac{1}{4}$.

(10) Work the following sums by using lines or oblongs, or strips of paper:

(*a*) $\frac{2}{3}+\frac{4}{5}$; (*b*) $1\frac{3}{4}+\frac{2}{3}$; (*c*) $\frac{3}{8}+\frac{2}{3}$;
(*d*) $1\frac{1}{4}+2\frac{1}{5}$; (*e*) $1\frac{5}{6}-1\frac{1}{2}$; (*f*) $2\frac{3}{8}-1\frac{3}{4}$.

(11) A can will hold $2\frac{1}{2}$ gallons of milk. If $1\frac{5}{8}$ gallons are poured in, how much more is required to fill the can?

(12) If a boy cut off $\frac{7}{10}$ of a piece of string, how much had he left?

(13) A farmer had 18 cows. If he sold $\frac{5}{6}$ of them, how many had he left?

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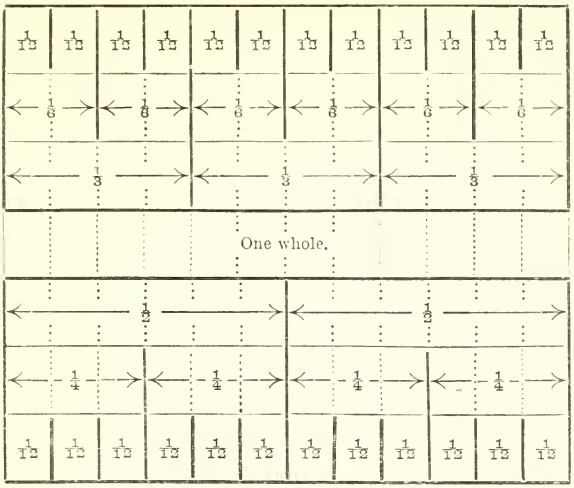
(14) A halfpenny measures 1 in. across. How many yards would £10 worth of halfpennies reach if placed side by side?

(15) Share 37486 bricks equally among 38 carters. How many are left?

(16) Make up a sum about quarters, and work it.



This diagram shows how to change fractions from one name to another, and thus we may work exercises in fractions by its help. Suppose, for example, we wish to add $\frac{1}{2}$ and $\frac{1}{3}$. From the diagram we see that $\frac{1}{2}=\frac{3}{6}$ and $\frac{1}{3}=\frac{2}{6}$; $\therefore\ \frac{1}{2}+\frac{1}{3}=\frac{3}{6}+\frac{2}{6}=\frac{5}{6}$.

Examples 1–6 should be worked with the help of the diagram.

(1) Write down these fractions as twelfths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{5}{6}$, $\frac{3}{4}$.

(2) Write down the number of twelfths in $\frac{1}{3}+\frac{1}{4}$; in $\frac{1}{2}+\frac{5}{6}$; in $\frac{3}{4}+\frac{1}{6}$; in $\frac{5}{6}+\frac{5}{12}$.

(3) Write these fractions in another way: $\frac{6}{12}$, $\frac{4}{12}$, $\frac{3}{12}$, $\frac{8}{12}$, $\frac{9}{12}$, $\frac{10}{12}$, $\frac{2}{12}$.

(4) What is the difference between $\frac{1}{3}$ and $\frac{1}{4}$? $\frac{2}{3}$ and $\frac{1}{6}$? $\frac{3}{4}$ and $\frac{1}{2}$? $\frac{1}{6}$ and $\frac{1}{3}$? $\frac{5}{12}$ and $\frac{1}{4}$?

(5) Work the following:

(*a*) $1\frac{1}{2}+1\frac{5}{12}$; (*b*) $1\frac{3}{4}+1\frac{1}{12}$; (*c*) $1\frac{1}{4}+1\frac{1}{3}+1\frac{1}{6}$; (*d*) $\frac{5}{6}+\frac{2}{3}+\frac{1}{12}$; (*e*) $\frac{3}{4}+\frac{1}{6}+\frac{7}{12}$; (*f*) $\frac{2}{3}-\frac{1}{12}$; (*g*) $1\frac{1}{4}-\frac{5}{12}$; (*h*) $2\frac{1}{3}-\frac{7}{12}$.

(6) Write these numbers in twelfths: $1\frac{1}{2}$, $1\frac{3}{4}$, $1\frac{2}{6}$, $1\frac{4}{6}$, $2\frac{1}{3}$, $2\frac{5}{12}$.

(7) Add together $\frac{2}{3}$ of £1, $\frac{3}{4}$ of £1, $\frac{1}{6}$ of £1, and $\frac{5}{12}$ of £1.

(8) (*a*) From £$\frac{2}{3}$ take £$\frac{7}{12}$; (*b*) from £$\frac{5}{6}$ take £$\frac{2}{3}$.

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(9) A clock loses **25** seconds per day. How many minutes will it lose during July and August?

(10) There are **26** houses in a street, and each lets at **5**s. **6**d. per week. How much rent is got from them in a year?

Exercise 8.—Metric System—the Metre,* etc.

(1) Reduce 3 Km. 5 Hm. 6 Dm. to (*a*) metres; (*b*) cm.

(2) 3·621 Km. = *a* Km. *b* Hm. *c* Dm. *d* m. What do *a*, *b*, *c*, and *d* stand for?

(3) Multiply 6 Km. 5 Hm. 4 Dm. 6 m. (*a*) by 8; (*b*) by 9. Work these sums in two ways.

(4) Work the following sums in two ways:
(*a*) 4 Km. 6 Hm. 5 Dm. 6 m. + 6 Km. 5 Dm. 1 m.;
(*b*) 8 Km. 5 Hm. 4 Dm. 8 m. − 4 Km. 6 Hm. 5 Dm.;
(*c*) 6 Km. 4 Hm. 5 Dm. − 3 Km. 4 Hm. 6 Dm.;
(*d*) 2 Km. 6 Hm. 4 Dm. 3 m. × 7;
(*e*) 6 Km. 4 Hm. 5 Dm. 8 m. ÷ 5.

(5) Work the following, and express the answers in Km.:
(*a*) 32 m. + 27 Dm. + 52 Hm.;
(*b*) 136 Hm. + 294 Dm. + 3694 metres.

(6) A Km. = 1095 yd. How many miles in 6 Km.?

(7) A metre = 39·37 inches. How many yards in 100 metres?

(8) A field is 1 Hm. 2 Dm. 5 m. long, and 9 Dm. 6 m. wide. How far is it all round?

(9) On a road posts are placed 6 metres apart. How many are there in a road 6 Km. 4 Hm. 2 Dm. 6 m. long?

(10) If an inch equals 2·54 cm., how many cm. short of a metre is a yard?

(11) How many pieces a metre long can be cut from a ball containing 6 Hm. 5 Dm. 6 m. of string?

(12) A Km. = 1095 yd. What is the difference in yards between 5 miles and 5 Km.?

(13) A man has to travel 5·627 Km. After going 3·168 Km. he rests. How far has he still to go?

(14) Make up a sum about measuring in Km., and work it.

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(15) There is an Indian coin called a rupee which is worth 1s. 4d. How many of these coins are worth £16, 10s. 8d.?

(16) Make out the following bill: 18 lb. of sugar at 2½d. per lb.; 8 stones of flour at 1s. 8d. per stone; 5 lb. of tea at 2s. 4d. per lb.; 6½ lb. of lard at 10d. per lb.

(17) What is the cost of flagging a causeway 25 yd. long and 3 yd. wide at 2s. 9d. per sq. yd.?

(18) What is the 49th part of £193, 12s. 0d.?

* For diagram see page 64.

Exercise 9.—Use of Compasses—Bisection of Lines and Perpendiculars.

(1) With your compasses draw three circles the same size. Join the centre of each to a point on its own circumference. What do you notice about these lines?

(2) Draw two circles each 1″ radius cutting each other. Join (1) the centres of the two circles and (2) the two points where the circles cross. Write down what you notice about these two lines.

(3) Draw a line 5·9 cm. long, and bisect it. Measure each part, and prove that your bisection is correct.

(4) Draw four lines any length, and bisect them. Test whether the work is correct by using tracing-paper.

(5) With your protractor draw two squares, having each side 3·2 in. long. Bisect all the sides, and join the points of bisection in each square in a different way.

(6) With the set square draw an oblong 5·6 cm. long and 3·8 cm. broad. Bisect each side, and join the points of bisection in two ways. What do you notice?

(7) Draw a circle $1\frac{1}{2}$″ radius. Let this stand for the face of a clock, and draw two lines showing where the hour-hand would be at 12 o'clock and 2 o'clock. How many degrees are there in the angle thus made? Make other angles like it.

(8) Draw a semicircle with a radius of $1\frac{1}{4}$ in. Divide the circular portion into 3 equal parts. Above the middle part, with its ends as centres, and with the same radius as before, draw two parts of a circle to cut each other. Join the point where they cut to the centre of the circle. Tell all you can about this line and the angles it makes with the diameter.

(9) Draw a line 3 in. long, and from the middle draw a perpendicular line just as was done in No. 8.

(10) Make a line 1·4 in. long; at the end erect a perpendicular.

(11) Draw a line 3·4 in. long, and at each end, by using your compasses, make a right angle.

(12) Using your compasses, make a square each side 3·6 in. long.

(13) Draw a circle 1·3 in. radius. Divide it into four equal parts. Join the points of division, and tell all you can about the new figure thus formed.

(14) If you can, draw a circle so as to touch each side of a square.

(1) In a year a joiner made **119** tables. If he received **11**s. **9½**d. for each, how much did he get altogether?

(2) In an ironwork there were **178** mechanics. If they were paid **£1**, **16**s. **8**d. each per week, what was the total amount paid weekly?

(3) A fruit merchant bought **144** barrels of apples at **12**s. **8¼**d. each. What was the total cost?

(4) Find the cost of **9** chains of fencing at **5**s. **8½**d. per yard.

(5) Round a school there are **156** boards, each **2** yd. **1** ft. **8** in. long. What is the total length of the boards in yd., &c.?

(6) A railway company ordered **170** rails, each **5** yd. **2** ft. **6** in. long. How many yards would all the rails reach?

(7) In a certain town there are **198** policemen. If each requires **3** yd. **1** ft. **6** in. of cloth for a suit, what length is needed for the whole force?

(8) A coal merchant bought **56** trucks of coal, with **8** tons in each, at **17**s. **8**d. per ton. What was the total cost?

(9) A Bradford sand merchant bought **98** tons of sand at Blackpool at **1**s. **6**d. per ton, and paid **£27**, **19**s. **5**d. for carriage. What was the total cost per ton?

(10) In a year a greengrocer sold **144** boxes of oranges for **£95**, **8**s. **0**d. How much is that per box?

(11) A farmer bought a flock of **128** sheep for **£247**, **9**s. **4**d. What was the average price per sheep?

(12) The distance round a park is **15** fur. **70** yd. **1** ft. **6** in. On the wall are fixed **126** pieces of wire of equal length. How long is each piece?

(13) A road is **6** fur. **91** yd. **2** ft. long, and is lighted by **78** street lamps placed at equal distances. What is the distance between two lamps? (N.B.—*There is a lamp placed at each end of the road.*)

(14) In measuring a distance of **3** fur. **12** yd., a man finds that it is just measured by laying down a certain stick **144** times. How long is the stick?

(15) What is the **78**th part of **£375**, **18**s. **6**d.?

(16) A ball of string **6** chains long is cut into **50** lengths equal to each other to the nearest inch. How much is left?

(17) Make up a sum about sharing **£20**.

Exercise 11.—Concrete Measuring.

(1) A poker is 1 ft. 9 in. long. How many pokers can be made from 36 pieces of iron each 14 yd. long?

(2) If each parcel needs 3 ft. 6 in., how many parcels can be tied up with a ball of string containing 365 yd. 6 in.?

(3) Tram rails are 18 ft. long. How many rails are required for 3 m. 6 fur.? (N.B.—*A tram requires* 2 *lines.*)

(4) A boy lives 1 m. 4 fur. from school. If his step is 2 ft. 3 in. long, how many steps will he take in going from home to school?

(5) The wheel of a motor-car is 6 ft. 9 in. in circumference. How many times does it turn round in going a distance of 4 m. 2 fur. 3 chains 14 yd.?

(6) The side of a square field is 8 chains 16 yd. long. How many rails 8 feet long are required to go round the field?

(7) It requires $3\frac{1}{2}$ yd. of cloth to make a man's suit. How many suits can be made from 3 pieces each 73 yd. 1 ft. 6 in. long?

(8) A man has to measure a distance of 13 chains 11 yd. with a stick 2 yd. 2 ft. 3 in. long. How many times must he put down the stick?

(9) A farmer made a sheep-pen 35 yd. long and 25 yd. wide with hurdles 7 ft. 6 in. long. How many are needed to go round?

(10) On a road 5 miles long the telegraph poles are 25 yd. apart. How many poles are there?

(11) A wheel 6 ft. 6 in. in circumference turns round 568 times in going a certain distance. What is the distance?

(12) A man tied up 346 parcels with pieces of string each 2 ft. 9 in. long. How many yards of string did he use?

(13) A man spent £15, 4s. $9\frac{1}{2}$d. on books. If the average cost was 5s. $6\frac{1}{2}$d. per book, how many books did he buy?

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(14) How many inches are there in x yards?

(15) Make up a sum about measuring the school-yard.

(16) What is left after sharing £250 equally among 34 men?

(17) What number multiplied by 78 will give the same result as 702×19?

(18) What must I pay for 37 dozen pencils at $1\frac{1}{2}$d. each?

Exercise 12.—Areas and Borders.

(1) A grass-plot is 27 feet long and 18 feet wide. How many square feet are there in it?

(2) All round the outside of the grass-plot a footpath is made 3 feet wide. Draw a plan of the grass-plot and the path, and find how many square feet there are in the path.

(3) The playing part of a football field is 180 yards long and 80 yards wide. How many square yards are there in it?

(4) All round the playing part is a path 3 yards wide. Draw a plan of the playing part and path, and find the length round the outside of the path.

(5) What is the difference between the length round the outside of the path and the length round the playing part?

(6) What is the area of the path in question 4?

(7) The blackboard on the wall is 12 feet long and 4 feet wide. It has a frame 4 inches wide round the outside. Draw a plan of the blackboard and frame, and find the total length of the pieces of wood needed for the frame.

(8) A picture has a white border 3 inches wide. The picture alone is 27 inches long and 24 inches wide. Draw a plan of the picture and border, and find (*a*) the area of the picture; (*b*) the area of the border.

(9) Outside a lawn 25 feet long and 15 feet wide is a path 2 feet wide. Draw a plan of the lawn and the path, and find the distance round the outside of the path.

(10) A garden is 18 feet long and 15 feet wide. All round it is a path 3 feet wide. Find the area of the path, and draw a plan of it.

(11) A bowling-green is 40 yards square, and has a path 2 yards wide all round it. Draw a plan of the green and path, and find the area of the path.

(12) The cupboard is 6 feet long and 4 feet wide. Find the area of the fronts of sixty such cupboards.

(13) Find the cost of painting the outside of a tank 6 feet long, 5 feet broad, and 4 feet deep, at $\frac{1}{2}$d. per sq. ft. (*The tank has a lid.*)

(14) A path is x feet broad and 75 feet long. What is the area of the path?

(15) A road contains x square yards. If it is 17 yards wide, how long is the road?

Exercise 13.—Graphic Arithmetic.

(1) Draw an oblong 4 inches long and 3 inches wide, and divide it into square inches. If each square represents 1d., colour blue the space worth 9d. and the space worth $\frac{1}{2}$d.

(2) Draw an oblong 4″ long and $3\frac{1}{2}$″ wide. Divide each side into quarter-inches, and then the area into quarter-inch squares. If each square represents 1 oz., show by colouring (*a*) $\frac{1}{2}$ lb.; (*b*) 2 lb.; (*c*) 4 lb.; (*d*) $\frac{1}{2}$ stone.

(3) From the oblong in (2) write down what part (*a*) 1 lb. is of 1 stone; (*b*) 1 oz. is of 1 stone; (*c*) 4 lb. is of 1 stone.

(4) Measure your reading-book and draw an oblong to represent a quarter of the size, and another to show half the size.

(5) The class-room door is 7 ft. high and 4 ft. wide. Draw an oblong to show this, and write down what stands for 1 ft.

(6) Measure (*a*) the top of a table; (*b*) the floor of a room; (*c*) a window. Draw oblongs to stand for these, and write over each what stands for 1 ft.

(7) Draw a line 6″ long, and divide it into 4 equal parts. Divide the first part into halves, then quarters, and then twelfths. With a scale of $1\frac{1}{2}$″ = 1 ft. draw lines representing the following lengths: (*a*) 2 ft.; (*b*) 1 ft. 6 in.; (*c*) 2 ft. 9 in.; (*d*) 1 ft. 4 in.

(8) Using the scale in question 7, draw oblongs the following sizes: (*a*) 3 ft. long, 2 ft. wide; (*b*) 2 ft. 6 in. long, 1 ft. 9 in. wide; (*c*) 2 ft. 3 in. long, 1 ft. 5 in. wide.

(9) ———————————————

This line represents 7 ft. What is the scale? Draw another line representing 3 ft. 9 in. on the same scale.

(10) This line represents 8 ft. What is the scale?

———————————————

Draw another line representing 4 ft. 6 in. on the same scale.

———————————————

(11) The divisor of a sum is 27, the quotient is £2, 16s. 8d., and the remainder is 18 pence. What is the dividend?

(12) Find the sum of £18, 19s. $9\frac{1}{2}$d., £37, 17s. $4\frac{1}{4}$d., £69, 19s. $5\frac{1}{2}$d., £47, 16s. $10\frac{1}{2}$d., £59, 18s. $9\frac{1}{2}$d.

(13) In 1903 coals were 16s. 6d. per ton, in 1913 £1, 1s. 6d. per ton. What is the increased cost of 120 tons?

Exercise 14.—Symbolic Arithmetic.

Where there is more than one step, each step should be shown. The working of such a sum as, 'How many boys are there in x schools, if each school contains y classes with z boys in each class?' should be shown thus:

Number of boys in each class $= z$ boys;
$\therefore$ " " y classes (or each school) $= yz$ boys;
$\therefore$ " " x schools $= xyz$ boys.

(1) How many pence are there in x shillings and y pence?

(2) How many inches are there in a feet b in.?

(3) How many inches are there in a yd. b ft. c in.?

(4) A piece of string is x yd. long. If m yards are cut off, how much is left?

(5) A man had a pounds. He spent b pounds on clothes and c pounds on food. How much had he left?

(6) A boy had x shillings. His father gave him y shillings, and he then spent z shillings. How much had he left?

(7) A field is m yd. long and n yd. wide. What is the area?

(8) A sheet of paper is a inches long and b inches wide. What is the area of c such sheets?

(9) There are c words in each line of a page of print, and d lines in the page. How many words are there in b pages?

(10) A man spent x pounds in buying y cows. What was the average price per cow?

(11) The area of a field is m sq. yd. If it is n yd. long, what is the width?

(12) A greengrocer gave x shillings for a barrel of apples containing 8 stones. What was the price per stone?

(13) If x stands for 2 and y for 3, what do these stand for:

(*a*) $x+y$; (*b*) $y-x$; (*c*) xy; (*d*) $2xy$; (*e*) $4xy$; (*f*) $\frac{x}{y}$; (*g*) $\frac{y}{x}$?

(14) A boy earns x shillings in 4 weeks. How many shillings does he earn in 20 weeks?

(15) 6 cows are worth £x each, and 7 horses are worth £y each. How much are all the cows and horses worth?

(16) The side of a square is a inches long. (*a*) What is the area of the square? (*b*) What is the area of 6 such squares?

(17) What would r books and s slates cost, at t pence each?

(18) Make up a sum about steps m feet long, and work it.

(1) Draw lines the following lengths: 1·25 dm., 1·37 dm., 2·18 dm. Find their total length.

(2) The rainfall on four days in December was ·27 in., ·36 in., ·48 in., and ·15 in. What was the total rainfall?

(3) The sides of a triangle measure 3·28 dm., 2·95 dm., and 2·17 dm. What is the distance round the triangle?

(4) Add together £1·35, £4·87, £2·64, and £3·87.

(5) The walls of the school-yard are 36·25 metres, 27·48 metres, 25·76 metres, and 26·45 metres long. What is the distance round?

(6) Add together 2·87 grams, 12·76 grams, 9·64 grams, and 6·85 grams.

(7) What is the difference between £3·24 and £1·65?

(8) Take the least quantity in question 6 from the greatest.

(9) A boy wrote 3·65 inches instead of 5·63 inches. How much was he wrong?

(10) The following are the weights of five boys: 34·6 Kg., 29·7 Kg., 42·4 Kg., 34·6 Kg., 37·8 Kg. Find the total weight.

(11) What is the difference between the lightest boy in question 10 and the heaviest?

(12) Add together 2·54 tons, 3·62 tons, 4·79 tons, and 3·46 tons.

(13) The rainfall for four days in May was ·25 in., ·47 in., ·245 in., and ·315 in. How much rain fell during these days?

(14) The rainfall for January and February was 7·545 in. In February it was 1·775 in. How much fell in January?

(15) For January and March the rainfall was 9·11 in. In January it was 5·77 in. What was it for March?

(16) A man bought 6·5 tons of coal in one wagon and 8·75 tons in another. He sold 9·85 tons. What amount of coal was there then?

(17) Make up a sum about £1·25 and £3·75, and work it.

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(18) In 1900 a man bought a piece of land for £2347, 18s. 6d. In 1913 he sold it for £4000. What did he gain?

(19) A running-track is 155 yd. long. How many furlongs does a man go in running 3 times up and down it?

(20) A butcher gave 7s. 6d. per stone for 48 stones of beef, and sold it, on an average, at 9d. per lb. What did he gain?

Exercise 16.—Measuring, Folding, and Cutting a Stiff Paper Bag.

(1) Measure in cm. the length and breadth of the paper required for the bag. If there are **45** boys in the class, what is the length round all the papers? What is the area of all the pieces?

(2) A hall is **18** yd. **2** ft. **6** in. long and **15** yd. **1** ft. **9** in. wide. What is the distance round it?

(3) Draw a plan of your bag half-size before it is gummed.

(4) The inside measurements of a box are **15** inches square and **9** inches deep. What area of paper is required to cover the inside of it? (*The box has no lid.*)

(5) A bedroom is **12** ft. square and **9** ft. high. If **34** sq. ft. are taken up by doors and windows, what is the cost of colouring the walls at 3d. per sq. ft.?

(6) A class-room is **24** feet long, **22** feet wide, and **10** feet high. Find the area of the wall-space if the windows and door occupy **80** square feet.

(7) The inside measurements of a tank are **14** ft. long, **12** ft. wide, and **8** ft. deep. If it is covered with lead, how many sq. ft. of lead are required? (*The tank has no lid.*)

(8) If a square foot of lead weighs $1\frac{1}{2}$ lb., what is the weight of lead used in the tank?

(9) Whitewashing costs $3\frac{1}{2}$d. per square yd. What does it cost to whitewash the inside of a mill **45** yd. long, **36** yd. wide, and **5** yd. high? (*Allow* **68** *square yd. for windows and doors.*)

(10) A room **66** feet long and **44** feet wide was boarded all the way round with boards **6** ft. high. How many square feet of boards were used?

(11) Paper for a bedroom is $1\frac{1}{2}$d. per square foot. What does it cost to paper a room **15** feet long, **12** ft. wide, and **9** ft. high, if the windows and the doors cover **26** sq. ft.?

(12) A joiner received an order for **12** packing-cases, each **4** ft. long, **3** ft. wide, and **3** ft. high. How many sq. ft. of boards did he use? (*The cases had no lids.*)

(13) There are **48** history reading-books for Class IV. If each book is **8·8** in. long and **6** in. wide, what is the total area of all the books?

(14) What is the price of **10000** bags at $4\frac{1}{2}$d. per **100**?

(15) Make up a sum about your paper bag.

Exercise 17.—Time Measure—I.

(1) Draw a line 6″ long, and show how you would represent 12 hr. by it. Show on this line the time you are at school in a day.

(2) How many minutes are there in (*a*) 1 dy. 8 hr.? (*b*) in 4 dy. 6 hr. 25 min.? (*c*) in 1 wk. 5 dy. 4 hr.?

(3) How many days in (*a*) 4892 hr.? (*b*) in 10120 hr.? (*c*) in 6894 min.? (*d*) in 29783 min.? (*e*) in 28564 sec.? (*f*) in 90386 sec.?

(4) How many weeks in 730 dy.? in 2464 hr.? in 5648 min.?

(5) The *Lusitania* takes 5 dy. 6 hr. 45 min. to go from Liverpool to New York. How many min. is that?

(6) A boy goes to school 425 times in a year, but is 10 min. late each time. How many days and hours does he lose?

(7) The tram-cars start from the terminus every 15 minutes. How many cars leave from 5 A.M. to 11.30 P.M.?

(8) It takes a milkman 3 hr. 45 min. to go his round. How much time does he spend in going his rounds during 3 days if he goes round twice a day?

(9) It is 64 miles from London to Brighton. If a cyclist goes in 4 hours, draw a line to show his speed per hour.

(10) In a year there are 365 days, 5 hr., 49 min. How many minutes is that? Why were there 366 days in 1912?

(11) How many more minutes were there in September, October, and November than in January, February, and March 1912?

(12) A factory works 54 hr. per week for 49 weeks in the year. How many days of 24 hours is this?

(13) Find the number of days during these periods: (*a*) 2nd Jan. to 3rd May 1913; (*b*) 4th Jan. to 8th May 1912; (*c*) 4th March to 6th June 1912; (*d*) 8th April to 15th July 1912; (*e*) 3rd Dec. 1911 to 14th March 1912.

(14) A clock strikes the hours only. How many separate strokes does it make in a week?

(15) Make up a sum about the playtime at school; work it.

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(16) A piece of cloth is 60 yd. long. What is the value of 100 pieces at 4s. 0d. per yd.?

(17) Add together the sum and difference of 3·65 m. and 2·78 m.

(18) Find the 47th part of £347, 18s. 9d.

(1) Add together 3 dy. 4 hr. 16 min., 5 dy. 13 hr. 25 min., 6 dy. 9 hr. 48 min., 12 hr. 17 min.

(2) On an average a joiner takes 5 hr. 45 min. to make a door. How long will he be in making 19 such doors?

(3) The time worked by 6 men is as follows: 36 hr. 30 min., 54 hr. 30 min., 48 hr., 65 hr., 44 hr. 30 min., 45 hr. 30 min. What is the average time worked?

(4) A clock goes 14 dy. with once winding up. If it gains 7 min. per dy., how much is it fast at the end of 14 dy.?

(5) It takes 5 dy. 14 hr. for a ship to go to New York, and 9 dy. 8 hr. for another to go to Montreal. How much longer does it take one than the other?

(6) A mill working night and day uses 34 tons of coal in 3 dy. 15 hr. 50 min. How long is that per ton?

(7) Add together 5 dy. 16 hr. 48 min., 4 dy. 34 min., 7 dy. 8 hr. 36 min., 3 dy. 18 hr. 25 min.

(8) From 16 hr. 29 min. take 12 hr. 47 min.

(9) Take 1 dy. 18 hr. 49 min. from 2 dy. 7 hr. 18 min.

(10) 15 hr. 16 min. × 5, 27, 37.

(11) 1 dy. 12 hr. 14 min. × 9, 47, 54.

(12) 15 dy. 6 hr. 27 min. ÷ 7, 21, 24.

(13) 8 wk. 2 dy. 8 hr. ÷ 10, 28, 50, 36.

(14) How many hr. are there (*a*) from noon on Sunday to the following Wednesday at 6 P.M.? (*b*) from 5 A.M. on Wednesday to 8 P.M. on the following Saturday?

(15) Find the weekly wages for the following men:

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Rate per hour.	Total Wages.		
W. Sharp.	$7\frac{1}{2}$ hr.	8 hr.	$6\frac{1}{2}$ hr.	9 hr.	10 hr.	4 hr.	8d.			
F. Johnson.	$9\frac{1}{2}$ "	10 "	8 "	$7\frac{1}{2}$ "	9 "	5 "	8d.			
J. Ellis.	$7\frac{1}{2}$ "	10 "	10 "	10 "	$8\frac{1}{2}$ "	5 "	$7\frac{1}{2}$d.			
W. Brook.	10 "	$8\frac{1}{2}$ "	$9\frac{1}{2}$ "	$7\frac{1}{2}$ "	10 "	$4\frac{1}{2}$ "	$7\frac{1}{2}$d.			
H. Lee.	10 "	8 "	$7\frac{1}{2}$ "	9 "	9 "	$5\frac{1}{2}$ "	$7\frac{1}{2}$d.			

(16) A joiner works 54 hours per week, and is paid 8d. per hour. What are the total wages of 17 joiners at that rate?

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(17) The wood for a packing-case cost $2\frac{1}{2}$d. per sq. ft. What is the cost of the wood for 4 such cases, each 4 ft. long, 3 ft. high, and 3 ft. wide? (*Each case has a lid.*)

(1) Find the value of x in the following: (*a*) £1·75 + £2·8 + £1·25 = x; (*b*) £2·4 − £3·65 + £1·8 = x; (*c*) 9·2 cm. + 3·5 dm. + 2·6 metres = x; (*d*) 3·8 tons + 2·7 tons + 2·75 tons = x.

(2) A man spent on an average £4, 18s. 9d. per week, and saved £2, 9s. 8d. per week. Find his annual income.

(3) A tram rail is 15 ft. long. How many rails are there in 1 mile 4 fur. of tram lines? (*A tram runs on two lines.*)

(4) Make out the following bill: 5 lb. of currants at 5½d. per lb.; 6 lb. of raisins at 7d. per lb.; 1 lb. 8 oz. of lemon-peel at 7d. per lb.; 5 doz. oranges at ½d. each; 8 lb. of figs at 5½d. per lb.

(5) A man gave £16 for a pig weighing 50 stones. He sold it at 7s. 6d. per stone. What did he gain?

(6) A grocer started on Monday with £25, 18s. 9½d. During the week he took £50, 17s. 4d., and paid a bill of £39, 16s. 8d. How much had he at the end of the week?

(7) A man's weekly wage was £2, 17s. 0d. If he paid 10s. 6d. per week for lodgings, 12s. 0d. for food, and 15s. 8d. for other expenses, how much did he save in a year?

(8) A merchant paid a cheque worth £178, 16s. 0d. for 48 tons of potatoes. How much were they per ton?

(9) With a coloured strip of paper show how many times 1·2 cm. can be taken from 1·8 dm.

(10) Find out the heights of the three highest mountains in England and Wales, and show them on squared paper.

(11) A farmer paid 1s. 9d. per yd. for fencing a field having sides the following lengths: 38 yd. 1 ft., 29 yd. 2 ft., 38 yd., 27 yd. 2 ft. What did it cost him?

(12) A man walks a mile in 18 min. 45 sec. How long does it take him to walk 9 miles?

(13) Planes are 4s. 6d. each, and saws are 3s. 9d. each. What is paid for 4½ dozen of each?

(14) How many min. are there from 9 A.M. on Monday to 4.30 P.M. on Thursday?

(15) A metre is 39·37 in. How many inches in 12 metres?

(16) Find the cost of 250 tons of coal at 17s. 6d. per ton.

(17) Make up a sum about finding the area of a room; work it.

Exercise 20.—Miscellaneous Exercises.

(1) Draw, cut out, and fasten in your exercise-book a triangle having each of two sides 7·4 cm. long, and the third side 5·8 cm. long.

(2) At the rate of 1½d. per ft., what is the cost of 12 rolls of wire, each measuring 1 chain 5 yd. ?

(3) On certain days in December the barometer stood at the following heights: 28·6 in., 28·9 in., 29·1 in., 29·3 in., 29·5 in., 29·2 in., and 28·7 in. On squared paper draw vertical lines to show these heights.

(4) How many iron rods each 2 ft. 9 in. long can be cut from 4 longer rods, each measuring 18 yd. 1 ft. ?

(5) What is the cost of paving a causeway 18 yd. long and 3 yd. wide at 7s. 6d. per sq. yd. ?

(6) A motor-car travelled 18·26 miles, 58·58 miles, 60·5 miles, and 27·65 miles. How far did it go in all ?

(7) 48 yd. of cloth cost £16. What is the price of 11 yd. ?

(8) A French franc is worth 9½d. What is the value of 1000 francs ?

(9) A town has 56 miles of tramways, and it costs 1·85d. per mile to run the cars. What is the cost of one journey over all the lines ?

(10) What is the amount of the following bill: 28 lb. of apples at 2½d. per lb., 9 stones of potatoes at 8½d. per stone, 16 cabbages at 2½d. each, 10 doz. bananas at 2 for 1½d. ?

(11) What is the value of x in the following:
2·4 metres + 3·6 metres + 4·8 metres + x = 12·4 metres ?

(12) A road is 4 miles long, and tramway pillars are placed the whole length. If they are 16 yd. apart, how many pillars are there ?

(13) A room is 16 ft. long and 14 ft. wide. There is a space 1 ft. 6 in. wide all round uncarpeted. What is the area of the carpet ?

(14) In a year a farmer pays £69, 10s. 0d. for rent, and his other expenses are £140, 13s. 0d. What must he get in a year so as to have £2, 10s. 0d. per week for himself ?

(15) How many samples each 1 ft. 3 in. long can be cut from a piece of cloth measuring 30 yd. ?

(16) (36 yd. 2 ft. 1 in. − 9 yd. 2 ft. 2 in.) × 67.

(17) Make a sum about measuring a garden, and work it.

Exercise 21.—Term Tests.

A.

(1) (*a*) Write 3·246 metres in another way.
(*b*) Draw a narrow oblong 9 cm. long, and show how often 1·5 cm. will measure it.
(*c*) By drawing a line show that $\frac{3}{5} = \frac{6}{10}$.
(*d*) Show by drawing an oblong that $ab = ba$.

(2) Pork is 7s. 6d. per stone. If a man sold 7 pigs for £28, 17s. 6d., how many stones did they weigh?

(3) A road is 1 m. 6 fur. 2 chains long. If telegraph posts are placed along it 22 yd. apart, how many are required?

(4) A man had boards measuring 2·65 metres, 4·87 metres, 3·85 metres, and 2·45 metres. If he required 20 metres in all, how much more must he get?

(5) What is the amount of the following bill: 36 eggs at 3 for 2½d.; 14 lb. of butter at 1s. 9d. per lb.; 18 lb. of lard at 11½d. per lb.; 600 cakes at 11½d. per doz.?

(6) A plot of ground 18 yd. long and 15 yd. wide has a foot-path 6 ft. wide all round it. What is the area of the path?

B.

(1) (*a*) A slate is 13″ × 11″ and the frame is 1″ wide. Draw a plan of it half-size.
(*b*) If a French girl went for ribbon, how much might she ask for?
(*c*) Show how to work the following sum: 1·4 in. × 6.
(*d*) What is division, a metre, and a product?

(2) A farmer sold 27 sheep at £3, 17s. 6d. each, and bought 36 lambs with the money. What was the value of each lamb?

(3) The sides of a field measure 48 yd. 2 ft., 2 chains 4 yd. 1 ft., 1 chain 20 yd., and 2 chains 9 yd. The rails round are each 9 ft. long. How many rails are there?

(4) Eggs are 8 for 1s. 0d. What is the value of 4200 eggs?

(5) A watch ticks once a second. How many times does it tick in 5 hr. 36 min. 48 sec.?

(6) (*a*) Write down the following in metres, and (*b*) take the least from the greatest: 26·25 dm., 216·5 cm., and 890 mm.

C.

(1) (*a*) Show how to work the following sum: $\frac{3}{4}$ in. + $\frac{2}{3}$ in.
(*b*) The base of a triangle is 5·6 cm. long, and two angles are 45° and 60°. Draw the triangle.
(*c*) Draw an oblong, and colour ·6 of it blue.
(*d*) Show by drawing a line how to take $\frac{7}{12}$ of a foot from $1\frac{3}{4}$ ft.

(2) How many feet are there in (*a*) *x* yards? (*b*) *a* inches? (*c*) Share *x* marbles equally among 6 boys.

(3) A boy lives 6 chains 15 yd. from school. If his step is 1 ft. 9 in. long, how many steps will he take in going to and coming from school?

(4) A gentleman had cheques for £19, 18s. 6d., £24, 16s. 9d., and £69, 14s. 7d. If he changed them into money, and shared it equally among 43 men so far as he could, how much did each man get, and how much had he left?

(5) The rainfall on 5 dy. in Dec. was ·36 in., ·94 in., ·06 in., ·17 in., and ·25 in. What was the total amount?

(6) How many yd. of cloth at 6s. 5d. per yd. can be bought for £28, 11s. 1d.?

D.

(1) (*a*) Draw the end of a house, and put on the drawing what you think the dimensions are.
(*b*) Show how to work the following: 3·2 in. × 6.
(*c*) Draw a line showing how many thirds there are in 4 in.
(*d*) Draw a triangle, and show that there are 180° in all the angles.

(2) Find the total wages of 45 men for a week at $9\frac{1}{2}$d. an hour. The men work 6 days, and average 9 hours a day.

(3) Find the fifty-seventh part of £428, 16s. $1\frac{1}{2}$d.

(4) Post and rail fencing is 1s. 3d. per yard. What is the cost of 3 chains 12 yards of fencing?

(5) A man left home at 8.30 A.M. on Monday, and returned at 6.30 P.M. on the following Wednesday. How many minutes was he away?

(6) Packets of soap are put into boxes, each holding 4 dozen. If there are 4000 packets, how many boxes can be filled, and how many packets are left?

(1) Butter is £4, 17s. 9½d. per cwt. What is the cost of 85 cwt.?

(2) In a year a wheelwright makes 78 carts at an average cost of £14, 17s. 8½d. What is the total cost?

(3) The carriage of woollen goods from Bradford to Liverpool is £1, 18s. 10d. per ton. What amount is paid for the carriage of 127 tons?

(4) The carriage of cotton from Liverpool to Manchester is 18s. 10½d. per ton. What is the amount paid for the carriage of 78 bales, each holding 3 tons?

(5) Tea is £7, 12s. 9d. per cwt. What is the cost of 3 lots, each consisting of 27 cwt.?

(6) A railway truck is 4 yd. 2 ft. 6 in. long. What is the length of 29 such trucks?

(7) A rod is 2 yd. 1 ft. 9 in. long. If it just measures a street when laid down 75 times, how long is the street?

(8) A skipping-rope is 2 yd. 2 ft. 7 in. long. What is left from a piece of rope 200 yd. long after 65 such ropes have been cut off?

(9) Coal is sold at 17s. 7½d. per ton. What amount is paid for 155 tons?

(10) Hay is £4, 18s. 9d. per ton. What is the value of a number of stacks containing 39 tons?

(11) In a mill there are 68 pieces of cloth each 18 yd. 1 ft. 11 in. long. What is the total length of all the pieces?

(12) In a year a manufacturer sells 158 dozen pairs of a certain kind of boots at £4, 16s. 9d. per dozen pairs. What is the amount received for them?

(13) Work the following sums:

(*a*) (£87, 19s. 8¼d. × 98) + (£128, 12s. 5¼d. × 67) = x;
(*b*) (£98, 14s. 7¾d. × 57) − (£87, 16s. 8¼d. × 48) = x;
(*c*) (6 yd. 2 ft. 8 in. × 47) + (9 yd. 1 ft. 10 in. × 58) = x;
(*d*) (9 yd. 1 ft. 7 in. × 87) − (7 yd. 1 ft. 8 in. × 57) = x.
(*e*) (2 dy. 7 hr. 15 min. × 34) − (1 dy. 5 hr. 18 min. × 24).

(14) Find the cost of the following: 13 score eggs at 10 for 6d.; 23 currant-loaves at 7½d. each; 14 lb. of butter at 1s. 4d. per lb.; 16 lb. of cheese at 9½d. per lb.; 14 lb. of lard at 6½d. per lb.

(15) Make up a sum about buying yards of cloth, and work it.

Exercise 23.—Compound Division.

(1) £298, 12s. 8d. ÷ 87.

(2) £386, 15s. 9d. ÷ 137.

(3) £395, 16s. 4d. ÷ 94.

(4) £478, 18s. 7d. ÷ 158.

(5) £694, 18s. 4d. ÷ 127.

(6) £549, 17s. 8d. ÷ 157.

(7) In 52 weeks a man earned £129, 2s. 8d. What were his average weekly wages?

(8) 87 tons of tram rails cost £424, 2s. 6d. What was the price per ton?

(9) In a year a woollen merchant paid £260, 0s. 0d. for the carriage of 120 tons of goods. What was the charge per ton? (*Work in two ways.*)

(10) The G.N. Railway charged £277, 10s. 0d. for the carriage of 148 tons of wool. What was charged for each ton?

(11) The weekly corn bill for 127 horses amounted to £112, 3s. 8d. What was the average cost per horse?

(12) The rent of 147 acres of land amounted to £378, 10s. 6d. What was the rent per acre?

(13) It took a joiner 10 dy. 8 hr. 24 min. to make 27 doors. What was the average time taken for each door?

(14) 156 tram rails just measure 3 furlongs 9 chains. What length is each rail?

(15) A merchant paid £693, 15s. 0d. for 25 wagon-loads of potatoes, each weighing 10 tons. What was the price per ton?

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(16) An iron rod is 6·45 dm. long. What is the length of 8 such rods?

(17) How many rails each 5 ft. 6 in. long are required to fence round a field 4 ch. 6 yd. long and 3 ch. 5 yd. wide?

(18) A man received £2, 6s. 0d. per week for wages. If he worked 6 dy. per week and 8 hr. per dy., how much did he earn per hr.?

(19) A room is 15 feet long and 13 feet wide. There is a border of oilcloth a yard wide all round the room, and the rest is covered with carpet. Draw a small plan of the room, colour blue the part covered with oilcloth, and find the area of the border.

(20) Make up a sum about the length and breadth of the house you live in, and work it.

(21) If $x = 6{\cdot}8$ inches $+ 9{\cdot}4$ inches $+ 8{\cdot}7$ inches, find x.

Exercise 24.—Multiplication of Fractions.

(1) Work the following sums by lines:
(*a*) $\frac{3}{4}$ in. $\times 6$; (*c*) $\frac{2}{3}$ in. $\times 7$; (*e*) $\frac{7}{10}$ cm. $\times 9$;
(*b*) $\frac{4}{5}$ in. $\times 8$; (*d*) $\frac{5}{8}$ in. $\times 4$; (*f*) $\frac{3}{5}$ cm. $\times 10$.

(2) On squared paper work the following:
(*a*) $\frac{5}{12}$ in. $\times 5$; (*c*) $\frac{4}{7}$ in. $\times 8$; (*e*) $\frac{2}{3}$ in. $\times 6$;
(*b*) $\frac{3}{4}$ in. $\times 7$; (*d*) $\frac{5}{8}$ in. $\times 7$; (*f*) $\frac{7}{12}$ in. $\times 9$.

(3) On squared paper draw these oblongs. Find the area of each, and show that the answer is correct by squares:
(*a*) $3\frac{1}{2}$ in. by 2 in.; (*c*) $3\frac{2}{3}$ in. by 3 in.; (*e*) $3\frac{2}{3}$ in. by 5 in.;
(*b*) $1\frac{3}{4}$ in. by 3 in.; (*d*) $4\frac{3}{5}$ in. by 4 in.; (*f*) $4\frac{5}{8}$ in. by 3 in.

(4) A box of tea weighs $\frac{3}{7}$ of a cwt. What is the weight of 8?

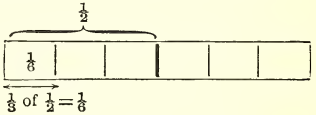
(5) What is the price of 12 lb. of woollen waste at $5\frac{3}{8}$d. per lb.?

(6) If a merchant raises the price of butter $\frac{5}{8}$s. per lb., how much is the increase on 12 lb.?

(7) The length of a boy's step is $1\frac{5}{12}$ ft. What distance does he go in 7 steps?

(8) What is the weight of 12 jars of jam, if each weighs $1\frac{3}{8}$ lb.?

(9) Show by folding strips of paper:
(*a*) $\frac{1}{4}$ of $\frac{2}{3}$; (*c*) $\frac{1}{2}$ of $\frac{3}{4}$;
(*b*) $\frac{1}{3}$ of $\frac{4}{5}$; (*d*) $\frac{1}{4}$ of $\frac{3}{8}$; thus:



(10) Draw oblongs 4 inches long and $\frac{3}{4}$ inch wide, and colour blue the part representing the answers to these sums:
(*a*) $\frac{1}{3}$ of $\frac{5}{8}$; (*c*) $\frac{1}{3}$ of $\frac{2}{3}$; (*e*) $\frac{1}{2}$ of $\frac{2}{3}$;
(*b*) $\frac{1}{2}$ of $\frac{3}{5}$; (*d*) $\frac{1}{4}$ of $\frac{5}{6}$; (*f*) $\frac{1}{4}$ of $\frac{4}{7}$.

---

(11) Make out the following bill: $2\frac{1}{2}$ lb. of lard at 7d. per lb.; $3\frac{1}{4}$ lb. of butter at 1s. 2d. per lb.; 5 doz. boxes of matches at $1\frac{1}{2}$d. per box; $2\frac{1}{2}$ doz. candles at $10\frac{1}{2}$d. per doz.; 2 lb. of coffee at $5\frac{1}{2}$d. per 4-oz. packet.

(12) A grocer had 6656 lb. of flour. He sold $\frac{1}{4}$ of it one week, $\frac{1}{8}$ the next, and half the next. How much flour was left? (*Work this sum in two ways.*)

(13) There are 48 barrels of machine-oil, each containing 36 gallons. How many pint-bottles can be filled from them?

(14) A boot-dealer bought 4 boxes of boots, each containing 36 pairs, for £81, 0s. 0d. If he gained 2s. 6d. per pair, how much did he sell each pair for?

(15) Make up a sum about measuring, and work it.

Exercise 25.—Avoirdupois Weight—I.

(1) Find the number of oz. in (*a*) 12 lb. 5 oz.; (*b*) 1 st. 8 lb. 12 oz.; (*c*) 6 stones 9 lb. 12 oz.

(2) How many oz. in (*a*) 3 cwt. 6 st. 5 lb.? (*b*) 12 cwt. 4 st. 7 lb.? (*c*) 1 ton 2 qr. 44 lb.?

(3) Find the number of lb. in (*a*) 2 tons 15 cwt.; (*b*) 3 tons 6 cwt. 2 qr.; (*c*) 3 tons 4 cwt. 3 qr. 4 lb.; (*d*) 4 tons 2 qr. 1 st. 8 lb.

(4) How many stones are there in 3648 oz.? in 4529 lb.?

(5) How many tons, cwt., qr., lb. are there in (*a*) 6944 oz.? (*b*) 8456 oz.? (*c*) 7647 oz.? (*d*) 4297 lb.? (*e*) 5647 lb.?

(6) In a coal-yard there are 6 trucks, each containing 9 tons of coal. If the coal is placed in $\frac{1}{2}$-cwt. bags, how many bags are required?

(7) How many 4-oz. packets of tea can be made out of 3 chests, each holding 56 lb.?

(8) A grocer bought 3 boxes of cocoa, each containing four dozen 4-oz. packets. How many stones of cocoa did he buy?

(9) Add together 6 st. 5 lb.; 4 st. 9 lb.; 3 st. 10 lb.; 5 st. 9 lb.; 7 st. 11 lb.

(10) Add together 3 cwt. 3 qr. 24 lb.; 2 cwt. 2 qr. 18 lb.; 4 cwt. 1 qr. 18 lb.; 4 cwt. 2 qr. 9 lb.

(11) Five boys are the following weights: 4 st. 8 lb. 6 oz.; 3 st. 9 lb. 10 oz.; 5 st. 10 lb. 9 oz.; 4 st. 11 lb. 10 oz.; 6 st. 12 lb. 10 oz. What is their total weight?

(12) (*a*) From 8 st. 10 lb. 4 oz. take 1 st. 11 lb. 12 oz.; (*b*) take 5 st. 3 lb. 14 oz. from 8 st. 1 lb. 3 oz.

(13) What is the difference in weight between two bags of flour, one weighing 7 st. 4 lb., and the other 3 st. 11 lb. 5 oz.?

(14) Take the least weight from the greatest of the following: 1 cwt. 2 qr. 7 lb.; 2 cwt. 14 lb.; 1 ton 3 cwt. 9 lb.; 4 cwt. 1 qr. 8 lb.

(15) From a sack of potatoes weighing 4 cwt. 1 qr. 14 lb. a greengrocer sold 2 st. 8 lb. to one person, 4 st. 11 lb. to another, and 1 st. 10 lb. to another. What weight of potatoes had he then?

(16) Make up a sum about weighing, and work it.

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(17) Find the value of x in the following: (*a*) $1\frac{2}{3}$ in. $+ 1\frac{1}{6}$ in. $+ 1\frac{1}{12}$ in. $= x$; (*b*) 3·56 cm. $+ 2·6$ cm. $+ 1·78$ dm. $= x$.

Exercise 26.—Avoirdupois Weight—II.

(1) A bar of soap weighs 1 lb. 2 oz. What is the weight of 9 such bars? of 12 bars? of 16 bars? of 20 bars?

(2) A cheese weighs 1 st. 12 lb. What is the weight of 8 similar cheeses? of 11 cheeses? of 24 cheeses?

(3) Half-a-sack of flour weighs 7 st. 8 lb. What is the total weight of 16 sacks? of 27 sacks?

(4) On a wagon there are 9 packages of bacon, each weighing 2 cwt. 1 qr. 6 lb. What is the total weight?

(5) A bale of wool weighs 2 cwt. 1 qr. 7 lb. What is the weight of 26 bales?

(6) The weight of a load of coke was 15 cwt. 2 qr. 12 lb., and of a load of coal 1 ton 2 cwt. 3 qr. What would be the total weight of 25 loads of each?

(7) A railway wagon is marked to carry 4 tons 3 cwt. 2 qr. What weight can be put into 15 such wagons?

(8) The total weight of 7 packages was 18 cwt. 1 qr. 21 lb. What was the average weight?

(9) 24 bars of soap weighed 3 stones. Find the weight of each.

(10) 9 railway goods-vans weighed 77 tons 10 cwt. 1 qr. What did each weigh?

(11) The school's football team of 11 boys weighed together 60 st. 7 lb. What was the average weight?

(12) Find the value of x in the following:

(a) (17 cwt. 3 qr. 4 lb. $\div 12$) + (18 cwt. 2 qr. 13 lb. $\div 15$) = x;

(b) (3 tons 12 cwt. 2 qr. 5 lb. $\div 25$) − (2 tons 19 cwt. 1 qr. $\div 28$) = x.

(13) An engine pulls 9 coal-wagons. Each empty wagon weighs 2 tons 12 cwt. 3 qr., and there are 5 tons 13 cwt. 1 qr. of coal in each. What is the total weight behind the engine?

(14) How often can 2 qr. 12 lb. of iron be weighed from 4 tons 9 cwt. 2 qr.? What weight is left?

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(15) A grocer bought 4 cwt. of bacon for £12, 1s. 4d., and sold it at 8d. per lb. How much did he gain?

(16) A mill uses 15 tons of coal per day at 12s. 9d. per ton. What does the coal used during 26 weeks cost? (*Do not reckon Sundays.*)

(17) Make up a sum about the weight of 24 pokers, and work it.

(1) Five boys weighed 31·6 Kg., 27·4 Kg., 33·2 Kg., 28·5 Kg., and 34·9 Kg. What was their total weight?

(2) One boy weighed 32·6 Kg., and another 29·8 Kg. What was the difference in their weights?

(3) On a cart there are 9 parcels, each weighing 14·6 Kg. What is the total weight?

(4) A roll of butter weighs 5·2 Kg. How many Kg. will 12 such rolls weigh?

(5) Write down the following in another way: 26·29 Kg.; 3·65 Dg.; 6·87 g.; ·125 g.

(6) A Kg. is about 2·2 lb. How many lb. are there in 9 Kg.? in 24 Kg.? in 36 Kg.?

(7) Work the following sums, giving the answers in Kg.:
(*a*) 3·44 Hg. + 26·5 Kg. + 647 g.;
(*b*) 15·67 Kg. + 364 g. + 26·875 Kg.;
(*c*) 3·87 Kg. − 368 Dg.;
(*d*) (36·8 Kg. × 9) + (27·5 Kg. × 7);
(*e*) (4·18 Kg. × 8) − (·264 Kg. × 6).

(8) A Hg. is $3\frac{1}{2}$ oz. How many Hg. are there in 70 lb.?

(9) A hollow cube, 1 cm. each side, holds 1 gram of water. How many such cubes are needed to hold $\frac{1}{2}$ a kilogram?

(10) On an average the 11 boys in a football team weigh 34·6 Kg. Find the total weight of the team.

(11) 1 cwt. = 50·8 Kg. Find the number of Kg. in 14 cwt.

(12) 1 ton = 1015 Kg. How many tons are there in 45675 Kg.?

(13) $2\frac{1}{5}$ lb. is about 1 Kg. How many Kg. are there in 1 ton 10 cwt.?

(14) Make up a sum about a French boy buying sugar, and work it.

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(15) 3 tons 4 cwt. 2 qr. of wheat is sold out in bags, each holding 4 stones. How many bags are required?

(16) A man paid a bill with 12 sovereigns and 1 half-sovereign. The shopman asked for one penny more, and then gave the man half-a-crown and a florin. What was the amount of the bill?

(17) A dealer bought 3 dozen sheep at two guineas each. Five died, and he sold the remainder at £2, 8s. 6d. each. What did he lose?

* For diagram see page 64.

Exercise 28.—Triangles.

Learn—(*a*) A triangle has 3 sides and 3 angles.
(*b*) An equilateral triangle has 3 equal sides and 3 equal angles.
(*c*) An isosceles triangle has 2 equal sides and 2 equal angles.
(*d*) A scalene triangle has 3 unequal sides and 3 unequal angles.
(*e*) The three angles of a triangle together contain 180°—i.e. they are equal to two right angles.
(*f*) Any two sides of a triangle are together longer than the third side.

(1) From gummed paper cut three narrow strips the same length. With these form a triangle. Write down its name and the size of each angle.

(2) From gummed paper cut a long strip of paper and make a triangle with two equal sides. Write down its name and the size of each angle.

(3) Make a scalene triangle with strips of paper, and give the size of each angle.

(4) Draw with compasses triangles having sides these lengths: (*a*) $3\frac{1}{2}''$, $2\frac{1}{2}''$, and $2''$; (*b*) $3\frac{1}{4}''$, $2\frac{1}{4}''$, and $1\frac{1}{2}''$; (*c*) $3''$, $2\frac{1}{4}''$, and $1\frac{1}{2}''$; (*d*) $2\frac{1}{2}''$, $1\frac{1}{4}''$, and $3''$.

(5) With the protractor make triangles with the following angles: (*a*) 60°, 60°, 60°; (*b*) 45°, 45°, 90°; (*c*) 60°, 45°, 75°; (*d*) 30°, 60°, 90°.

(6) Using coloured paper, draw and cut out the triangles in question 5. Cut off the angles, and put them together to make 180°.

(7) Cut out 2 triangles with angles 30°, 60°, 90°. Put them together to form an equilateral triangle.

(8) Draw a square, each side 3″. Cut it into four right-angled triangles.

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(9) A collection for the poor amounted to £47, 3s. $10\frac{1}{4}$d. This was shared equally among 21 men and 20 women. How much did each get?

(10) A librarian spent £26, 12s. 6d. in books. If he bought 45 at 3s. 6d., and the remainder cost 7s. 6d. each, how many at 7s. 6d. did he buy?

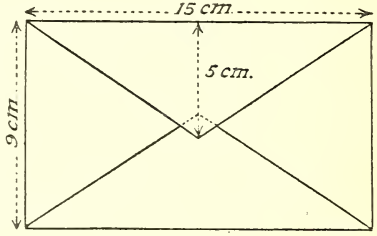
(11) Make up a sum about yourself, and work it.

Exercise 29.—Drawing to Scale.

(1) Draw a square having each side 8 cm. long. Draw another with sides half this length. Write down the area of each, and say what you notice about them.

(2) Draw oblongs having sides the following lengths: (*a*) 6″×4″, (*b*) 8″×4″, (*c*) 10 cm.×6 cm. Draw three other oblongs having sides half the lengths of those above, and write inside the area of each.

(3) The drawing represents the back of an envelope. Draw another with half the dimensions.



(4) The following lines represent the distances written over them. Give the scale to which each is drawn.

(*a*) 6 ft.

(*b*) 1 ft.

(*c*) 6 in.

(*d*) 1 ft. 9 in.

(*e*) 1 ft.

(5) A table-top is 3 ft. 4 in. long and 2 ft. 3 in. wide. Draw a plan of it to a scale of 1″ to 1 ft.

(6) Draw the following lines to a scale of 2″ to 1 ft.: (*a*) 1 ft. 9 in.; (*b*) 2 ft. 6 in.; (*c*) 2 ft. 3 in.

(7) Make a scale of $\frac{1}{2}$″ to 1 ft., and draw lines to represent: (*a*) 6 ft. 3 in.; (*b*) 5 ft. 6 in.; (*c*) 7 ft. 9 in.

(8) A garden-plot is 18 yd. long and 14 yd. wide. Draw this to the scale you think most suitable.

(9) Round the plot in question 8 there is a path 1 yd. wide. Draw a plan of the garden-plot and path.

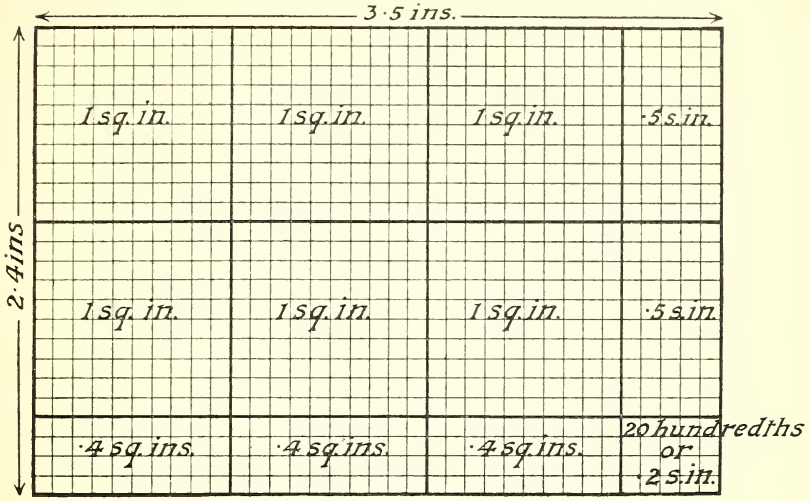
(10) A newspaper cover is 40 in. long and 30 in. wide. Draw this to a scale of $\frac{1}{10}$.

(11) A table-top is 5 ft. 6 in. long and 4 ft. 3 in. broad. Draw a plan of it on a scale of 1″ to 1 ft.

(12) Measure the blackboard in your class-room, and draw it to any scale you think best.

(13) Measure the doorway into your class-room, and draw it to a scale of 1″ to 1 ft.

DIAGRAM TO ILLUSTRATE MULTIPLICATION OF DECIMALS.



STATEMENT

3 sq. ins. × 2 = 6 sq. ins.
·5 sq. ins. × 2 = 1 " "
·4 sq. ins. × 3 = 1·2 " "
·5 sq. ins. × ·4 = ·2 " "
Total 8·4 sq. ins.

(1) Show on squared paper the answers to the following: (*a*) 1·5 inches × 5; (*b*) 3·4 inches × 3; (*c*) 4·7 inches × 2.

(2) Draw lines 3 inches, 4 inches, and 5 inches long, and write over them their length in centimetres.

(3) One inch equals 2·54 cm. How many cm. are there in 6 inches? in 8 inches? in 9 inches?

(4) A metre is 39·37 inches long. How many inches are equal to 9 metres?

(5) A kilogram is equal to 2·2 lb. How many lb. are equal to 12 Kg.?

(6) A reading-book is 7·4 inches long and 6 inches wide. What is the total area of 15 such books?

(7) Cloth costs 5·75 shillings per yd. Find the cost of 9 yd.

(*Continued on page 32.*)

(8) Find the value of x in the following:
(a) $(5{\cdot}64 \text{ in.} \times 8)+(4{\cdot}64 \text{ in.} \times 6)=x$;
(b) $(6{\cdot}32 \text{ dm.} \times 7)-(3{\cdot}87 \text{ dm.} \times 6)=x$;
(c) $(3{\cdot}82 \text{ metres} \times 5)+(6{\cdot}54 \text{ metres} \times 7)=x$.;
(d) $(8{\cdot}27 \text{ grams} \times 3)-(2{\cdot}76 \text{ grams} \times 8)=x$.

(9) On squared paper find the area of the back of your arithmetic book.

(10) On squared paper find (a) the area of a piece of paper 3·4 inches long and 2·7 inches wide; (b) the area of a post-card 4·6 inches long and 3·4 inches wide.

(11) If one inch stands for a yard, find by using squared paper the area of a floor 3·5 yards long and 2·8 yards wide.

(12) What is the cost of 9 lb. of wool at 16·75d. per lb.?

(13) If a litre is 1·76 pints, how many pints in 8 litres?

(14) The average rainfall for 7 months was 2·68 in. per month. How much rain fell during those months?

(15) A table is 4·75 metres long and 3 metres wide. What is the total area of 5 such tables?

(16) A school exercise-book is 8·6 in. long and 7 in. wide. What is the length round 8 such books?

(17) Find the value of x in the following:
(a) $(£6{\cdot}65 \times 8)+(£3{\cdot}86 \times 7)=x$;
(b) $(30{\cdot}87 \text{ g.} \div 9)+(26{\cdot}35 \text{ g.} \div 5)$.
(c) $(4{\cdot}27 \text{ m.} \times 9)-(3{\cdot}18 \text{ m.} \times 7)=x$;
(d) $(£3{\cdot}25 \times 7)-(£1{\cdot}85 \times 11)=x$.

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(18) On one occasion, the navy bought steam coal at Cardiff at 15s. 6d. per ton, and paid 9s. 9d. per ton for carriage to Glasgow. What was the total cost of 16 trucks, each containing 8 tons?

(19) What is the cost of 1 cwt of soap, if 98 cwt. cost £130, 17s. 5d.?

(20) A wheel is 5 ft. 6 in. in circumference. How often does it turn round in going 2 m. 3 fur. 6 ch.?

(21) A boy leaves home at 8.40 A.M. and gets back at 4.45 P.M. How many minutes is he away during five days?

(22) Make up a sum about measuring in dm., and work it.

Exercise 31.—Graphic Arithmetic.

(1) $\frac{1}{10}''=1$ yd. A school-yard is 36 yd. long and 27 yd. wide. Draw a plan of the yard on squared paper, and find how many sq. yd. there are in it.

(2) $5\frac{1}{2}$ yd. $=1$ pole. Draw a figure to show how many sq. yd. there are in a sq. pole.

(3) The Thames is 210 m. long, the Shannon 254 m. long, and the Tay 120 m. long. If one square represents 10 m., draw lines to show the lengths of these rivers.

(4) A school is 600 feet above sea-level. Snowdon is 3560 ft. high, Cader Idris 2914 ft., Plinlimmon 2469 ft., and the Peak 2082 ft. If an inch represents 200 ft., show the heights of these mountains and of the school above sea-level.

(5) In December the lengths of the shadows made by a pole were: 9 A.M., 7 yd. 2 ft; 10 A.M., 7 yd. 1 ft.; 11 A.M., 6 yd. 1 ft.; 12 noon, 5 yd. 1 ft.; 1 P.M., 6 yd. 1 ft.; 2 P.M., 7 yd.; 3 P.M., 7 yd. 2 ft. Draw vertical lines to represent these, and join the upper ends by a curved line.

(6) In a school the temperature was as follows: Monday morning 55°, afternoon 59°; Tuesday morning 56°, afternoon 60°; Wednesday morning 61°, afternoon 57°; Thursday morning 58°, afternoon 62°; Friday morning 60°, afternoon 62°. Draw vertical lines to represent these temperatures, and join the upper ends by a curved line.

(7) The prices of joiners' chisels are as follows: $\frac{1}{4}''$ chisel, 5d.; $\frac{5}{8}''$ chisel, 6d.; $\frac{3}{4}''$ chisel, $7\frac{1}{2}$d.; $\frac{7}{8}''$ chisel, 8d.; $1''$ chisel, $8\frac{1}{2}$d.; $1\frac{1}{4}''$ chisel, 9d.; $1\frac{1}{2}''$ chisel, 10d. Draw vertical lines to represent these values, and join their upper ends by a curve.

(8) Fix a point on your squared paper, and call it *o*. From this draw a vertical line *oy*, and a horizontal line *ox*. Place dots to stand for the following points:

(*a*) a point 12 in. from *oy* and 8 in. from *ox*.
(*b*) " 15 in. from *oy* and 9 in. from *ox*.
(*c*) " 2 ft. from *oy* and 1 ft. 6 in. from *ox*.

(9) Six boys are the following heights: 4 ft. 4 in., 4 ft. 10 in., 5ft., 5 ft. 2 in., 5 ft. 4 in., 5 ft. 6 in. Draw vertical lines to show their heights, and join their tops by a curve.

(10) Make up a sum about lengths of sticks, and draw vertical lines to stand for them. Write down below your drawing upon what scale it is drawn.

(1) A railway engine pulls 28 trucks. Each truck weighs 2 tons 15 cwt. 2 qr., and contains 8 tons 14 cwt. 1 qr. of coal. What is the total weight drawn by the engine?

(2) How often can a bag holding 1 st. 7 lb. be filled from 3 tons 4 cwt. 2 qr. of flour?

(3) How many $\frac{1}{4}$-lb. tins of coffee can be filled from 15 cwt. 3 qr. 9 lb.?

(4) Raw wool is 1s. $1\frac{1}{2}$d. per lb. Find the cost of a bale weighing 15 cwt. 2 qr. 10 lb.

(5) A man sells pigs at 7d. per lb. What sum does he get for 2 pigs if one weighs 28 stones and the other 27 stones?

(6) A tub of butter containing 1 cwt. 1 qr. 16 lb. costs £9, 8s. 6d. What is the price per lb.?

(7) Coal is bought at 16s. 9d. per ton, and sold out in bags, each weighing 1 cwt., at 1s. 1d. each. How much profit is made on 25 tons?

(8) How many oz. are there in $1\frac{5}{8}$ lb. $+ 4\frac{3}{4}$ lb. $+ 3\frac{3}{8}$ lb. $+ 1\frac{1}{2}$ lb.?

(9) Make out the following bill: 2 cwt. of wheat at 1s. 3d. per stone; $1\frac{1}{2}$ cwt. of meal at 1s. 8d. per stone; $2\frac{1}{2}$ cwt. of oats at 1s. 2d. per stone.

(10) The axle of a wagon weighed 1 cwt. 2 qr. 10 lb. What is the total weight of 26 such axles?

(11) A railway truck weighed 2·65 tons. What was the total weight of 89 such trucks?

(12) There were 29 sacks of flour on a wagon. Each empty sack weighed 5 lb., and when filled contained 2 qr. 18 lb. of flour. What was the total weight on the wagon?

(13) Twenty-five lb. of tea at 1s. 9d. per lb. were mixed with 60 lb. at 1s. 4d. per lb. The mixture was sold at 1s. 8d. per lb. What was the profit?

(14) A grocer bought $2\frac{1}{2}$ cwt. of tea for £16, 1s. $10\frac{1}{2}$d., and sold it at 1s. 6d. per lb. What did he gain?

(15) Make up a sum about 2 cwt. of cheese, and work it.

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(16) Find the 37th part of £458, 18s.

(17) Straw is $7\frac{1}{2}$d. per stone. Find the cost of 6 tons 12 cwt.

(18) Wire-rope weighs 5 lb. to the yard. How many cwt. are there in a coil 6 ch. 12 yd. long?

(1) 1 cwt. 2 qr. 12 lb. of tea is sold at 7d. for 4 oz. How much is got for it?

(2) Work the following bill: 120 sheets of drawing-paper at $1\frac{1}{2}$d. per sheet; 15 boxes of colours at $10\frac{1}{2}$d. per box; 2 gross of exercise-books at 9d. per doz.; 48 reading-books at 1s. 3d. each.

(3) A farmer sold 76 tons of turnips at £2, 16s. 9d. per ton, and with the money he bought 152 lambs. What was the price of each lamb?

(4) An iron-merchant bought 6 fur. 8 chains 10 yd. of piping at 1s. 3d. per yd. What sum did he pay for the whole?

(5) A grocer bought 5 tons 15 cwt. 2 st. of flour at the rate of 1s. 2d. per stone. How much did it cost him?

(6) In a wool-combing shed 155 men are employed. If their average wage is 18s. $10\frac{1}{2}$d. per week, how much is paid altogether?

(7) Work the following bill: 26 yd. of muslin at $11\frac{1}{2}$d. per yd.; 8 doz. yd. of calico at $5\frac{1}{2}$d. per yd.; $4\frac{1}{2}$ doz. reels of cotton at $2\frac{1}{2}$d. each; 46 yd. of flannel at 1s. $1\frac{1}{2}$d. per yd.

(8) A man earns £1, 15s. 0d. per week. He pays 5s. 6d. for rent, 9s. 9d. for groceries, and for other expenses 8s. $5\frac{1}{2}$d. At this rate what does he save in a year?

(9) It cost £54, 15s. 0d. to make a causeway on a road which is 6 chains 14 yd. in length. What was the cost per yd.?

(10) A coal-merchant bought 6 trucks of coal, each containing 9 tons, at 16s. 10d. per ton, and sold the coal at 19s. 8d. per ton. What was his total gain?

(11) What has a merchant left out of £200 after buying 56 cwt. of bacon at £2, 18s. 9d. per cwt.?

(12) Make up a sum about buying 1 cwt. of soap, and work it.

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(13) Work these sums: (*a*) $(2\frac{1}{2}$ in. $+3\frac{1}{5}$ in.$)-(3\frac{1}{2}$ in. $+1\frac{4}{5}$ in.$)$; (*b*) $2\frac{1}{3}$ in. $+3\frac{3}{4}$ in. $+1\frac{1}{2}$ in.; (*c*) 4·37 in. $+6·49$ in. $+8·37$ in. $+5·43$ in.

(14) Bricks are £1, 16s. 0d. per 1000. Find the cost of 50000.

(15) Concreting costs 3s. 6d. per square yard. What does it cost to make a concrete floor 48 yd. long and 36 yd. wide?

(16) The quotient was 5 yd. 1 ft. 4 in., the divisor was 59, and the remainder was 34 inches. What was the dividend?

(1) A box is a ft. long and b ft. wide. Find the distance round the lid.

(2) What is the total distance round the top and the bottom of the box in question 1?

(3) Draw a square, and then draw one diagonal. Mark the sides a inches long, and the diagonal b inches long. Write down: (*a*) the distance round the square; (*b*) the total perimeter of the two right-angled triangles.

(4) A door is x ft. long and y feet wide. Find the area of the door, and the distance round it.

(5) A table is a feet long and b feet wide. What is the distance round 6 such tables?

(6) One side of an equilateral triangle is x ft. long. Find the distance round the triangle.

(7) The side of an isosceles triangle is a inches long, and the base is b inches long. How far is it all round?

(8) One side of a scalene triangle is a inches long, another b inches long, and another c inches long. What is the total length of all the sides?

(9) Each side of an equilateral triangle is $2x$ inches long. What is the total length of the sides?

(10) The equal sides of an isosceles triangle are each $4a$ inches long, and the base is half this length. What is the distance round the triangle?

(11) Each side of a triangle is $(2a+1)$ inches long. Find the perimeter.

(12) The equal sides of an isosceles triangle are each $(2x+2)$ cm. long. The base is half the length of the side. What is the perimeter?

(13) A box is a in. long, b in. wide, and c inches deep. Draw a figure to show both the two sides and the two ends of the box in one drawing. Write the dimensions on the figure, and find:

(*a*) the total length of your drawing;
(*b*) the sum of the length and the width;
(*c*) the distance all the way round it;
(*d*) the total area of the figure.

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(14) Write down what scale you think is most suitable for a plan of your class-room.

Exercise 35.—Measure of Capacity.

(1) How many quarts are there in 3 casks of oil containing 36 gal. 2 qt., 38 gal. 1 qt., and 39 gal. 3 qt.?

(2) What is the total capacity of 4 milk-cans holding 18 gal. 1 qt. 1 pt., 16 gal. 2 qt. 1 pt., 15 gal. 3 qt., and 12 gal. 1 pt.?

(3) An oil-tank holds 96 gal. 2 qt. If 27 gal. 3 qt. are drawn out, how much is there still in the tank?

(4) A milkman measures 346 pt. of milk in a week. How many gal. does he measure?

(5) There are 36 patients in a hospital, and each drinks 2 pints of milk per day. How many gal. are needed in 7 days?

(6) How many pint-bottles of wine can be filled from a cask holding 38 gal. 2 qt. 1 pt.?

(7) A milkman sold 6. gal. 2 qt. 1 pt. of milk every day during Feb. 1912. How much did he sell in all?

(8) During the year 1912 a boy drank 1 pint of milk each day. How many gal. did he drink?

(9) A man gave £36 for 28 gallons of wine, and sold it at 2s. 4d. per half-pint. How much did he gain?

(10) A corn-bin holds 16 bushels 2 pk. If a gallon is used daily, how long will the corn last?

(11) A hamper of potatoes when full contains 4 bushels 3 pk. 1 gal. What will 8 such hampers hold? What will 38 such hampers hold?

(12) A pint of water weighs $1\frac{1}{4}$ lb. How many lb. of water are there in a cask containing 37 gal. 2 qt. 1 pt.?

(13) What is the value of 18 bushels 1 peck of corn at 1s. 8d. per peck?

(14) In 19 full casks of the same size there are 358 gal. 2 qt. 1 pt. of oil. How much does each cask hold?

(15) A sack holds 4 bushels 1 pk. of wheat. How many such sacks are required for 114 bushels 3 pk.?

(16) Make up a sum about potatoes, and work it.

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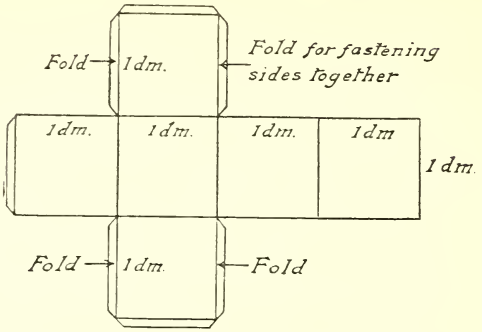
(17) A firm employed 156 men, and paid them 4s. 9d. per day. How much did all the men earn in 5 days?

(18) A tradesman bought 85 sacks of flour at 1s. 2d. per stone, and sold the flour at 1s. 5d. per stone. If each sack weighed 18 stones, what did he gain?

(1) Make a cube from the following drawing:



(2) Make a cube to hold a quarter of the quantity which the cube in question 1 holds.

(3) Make a square box to hold half as much as the cube in question 1.

(4) Fill each of your boxes with sand, and write down how many litres there are in each. Then pour the sand from each into a pint-measure. What do you notice?

(5) Fill a gallon-measure with sand by using the box made in question 1. What do you notice?

(6) How much less is 4 litres of water than a gallon? (*Give the answer in English measure*—1 *litre* = 1·76 *pt.*)

(7) If a litre = $1\frac{3}{4}$ pints, how many litres are there in a cask holding 28 gallons?

(8) A litre is 1·76 pints. How many pints are there in a cask holding 3 hectolitres?

(9) Write down how the measure of capacity in the Metric System is connected with the measure of length.

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(10) A miner is paid 7s. 6d. a day. What amount will 84 miners lose who play a week? (6 *days in a week.*)

(11) A man sold tea at 7d. for 4 oz. How much did he get for a chest holding 64 lb.?

(12) A clock loses $2\frac{1}{4}$ min. per day. How long does it take the clock to lose 12 hours 9 min.?

(13) By drawing an oblong show that $\frac{3}{4} = \frac{6}{8}$.

(14) Make up a sum about litres, and work it.

(1) A man goes from London to Bradford and back 35 times in a year. If each journey takes 4 hr. 20 min., how many days, &c. does he spend in travelling?

(2) A sack holds 18 pecks 1 gal. of peas. How many qr. of peas are there in a truck-load of 48 sacks of peas?

(3) A coil of wire is 2 m. 6 fur. 2 ch. in length. How many pieces, each 2 yd. 1 ft. 6 in., can be cut from it?

(4) A cheese weighs 2 st. 6 lb. 8 oz., and a tub contains 64 lb. of butter. On a wagon there are 35 of each. If the wagon itself weighs 1 ton 5 cwt. 2 qr., what weight does the horse draw?

(5) (*a*) 3 cwt. 3 qr. 8 lb. + 2 tons 3 qr. 7 lb. + 5 tons 13 cwt. 20 lb. + 13 cwt. 3 qr. 24 lb.;
(*b*) 3 m. 2 fur. 6 ch. 5 yd. − 1 m. 6 fur. 4 ch. 12 yd.;
(*c*) 3 wk. 4 dy. 8 hr. − 1 wk. 6 dy. 19 hr.;
(*d*) (3 gal. 2 qt. 1 pt. × 29) + (4 pk. 1 gal. 2 qt. 1 pt. × 47);
(*e*) (3 tons 15 cwt. 3 qr. × 37) − (18 cwt. 2 qr. 1 st. 7 lb. × 43);
(*f*) (4 fur. 6 ch. 12 yd. 1 ft. × 53) − (2 m. 4 fur. 19 ch. 20 yd. ÷ 59);
(*g*) 13 tons 12 cwt. 3 qr. ÷ 23, 47, 58, 67;
(*h*) 3 bush. 3 pk. 1 gal. 1 qt. × 46, 53, 69.

(6) The length of a road is 1 m. 4 fur. 7 ch. 14 yd. There are 55 telegraph-posts placed at equal distances. What is the distance between the posts?

(7) During a year a corn merchant sells 125 tons 15 cwt. of wheat at an average price of 11½d. per stone. What is the value of the wheat sold?

(8) A man charges 1s. 6d. per hour for mowing with a machine. If he works from 4.30 A.M. each day to 7 P.M., with 1½ hours off for meals, how much will he earn in 6 days?

(9) A gallon of oil weighs 9¼ lb. What is the weight of oil in 14 casks, each containing 36 gallons?

(10) The roof of a church is 20 yd. long and each side is 9 yd. deep. How much will it cost to cover the roof with tarred felt at 4½d. per sq. yd.?

(11) 7 tons of coal were delivered in a day. There were 63 bags, each holding 1 cwt., and the rest of the coal was in ½-cwt. bags. How many of these were there?

(12) A baker bought 6 sacks of flour, each holding 3½ cwt. How many 2-lb. loaves could be made from the flour?

(1) A bar of iron weighs 3 cwt. 2 qr. How many such bars can be made out of 21 tons 14 cwt. of iron?

(2) Telegraph-posts are placed 1 chain 10 yd. apart along a road 3 m. 2 fur. 6 chains 4 yd. long. How many posts are there?

(3) Beans are $9\frac{1}{2}$d. per peck. What is the price of 38 sacks, each containing 4 bushels 3 pecks?

(4) A man bought 175 tons of coal for £153, 2s. 6d. He paid £8, 15s. 0d. for carriage, and made a profit of £13, 2s. 6d. How much per ton did he sell the coal for?

(5) A grocer sold eggs at 7 for 6d. How much did he get for 12 boxes, each containing 868 eggs?

(6) Coffee is 1s. 9d. per lb. How many cwt., qr., &c. can be bought for 55 guineas?

(7) A farmer bought 37 lambs at £1, 18s. 9d. each, and 29 pigs at £1, 5s. 8d. each. What was the total amount spent?

(8) Work the following bill: 3 stones of flour at 1s. $3\frac{1}{2}$d. per stone; $4\frac{1}{2}$ lb. of butter at 1s. 5d. per lb.; $3\frac{1}{2}$ lb. of tea at 2s. 5d. per lb.; a gross boxes of matches at 2 boxes for $1\frac{1}{2}$d.; 6 oz. of pepper at 1s. 0d. per lb.

(9) A gallon of water weighs 10 lb. What weight of water is there in a tank containing 500 gallons?

(10) A boy had x marbles, and his brother John had $3x$ marbles. How many had they together?

(11) Make a sketch of a fireplace, and put on it the dimensions. Draw it to a scale of $1'' = 1$ ft.

(12) Add together $2\frac{1}{4}$ tons, $1\frac{2}{3}$ tons, and $2\frac{1}{6}$ tons.

(13) Add together £3·25, £1·06, £3·12, and £2·34.

(14) A grocer had half-a-ton of flour. He sold $\frac{5}{6}$ of it. What fraction of the flour had he then?

(15) (*a*) £12·25 + 12·25s. + 11·25d. − £10·6;
(*b*) 19·75 tons + 15·5 cwt. − 2·25 qr.;
(*c*) 3·25 qr + 11·25 lb. − 2·5 stones.

(16) A grocer bought $1\frac{1}{2}$ tons of currants for £84, 0s. 0d., and sold half at $6\frac{1}{2}$d. per lb., and the rest at $7\frac{1}{2}$d. per lb. What did he gain?

(17) What is the cost of 98 tons of hay at £5, 17s. 9d. per ton?

(18) Write down a sum about buying coal, and work it.

(1) If 42 scholars in a class came early on Monday morning, and 4 came late, how many scholars had the teacher that morning?

(2) Measure the width of your open exercise-book. If 20 such open books were placed side by side, how far would they reach?

(3) A boy had 12 score and 10 marbles. He won 27 more. How many had he then?

(4) A woman bought 28 yards of linen at 1s. 5½d. per yard, and had 2s. 10½d. left. How much had she at first?

(5) A man bought 60 dozen bottles of soda-water at 9d. per doz., and sold them at 1d. a bottle. What did he gain?

(6) A man started to walk a distance of 11½ miles. After going a mile he found that he had forgotten his watch, and returned for it. He then walked to his destination. How many yd. had he walked?

(7) Along a road there are 25 lamps 35½ yd. apart. How many yards will a lamp-lighter walk in going from first to last?

(8) Find by as short a method as possible the cost of 39 sheep at £1, 18s. 9d. each.

(9) A fly walks round the edge of an open book till it reaches the starting-point. Supposing the book was your exercise-book, find, without opening it, how far the fly walks.

(10) What numbers, each multiplied by itself, will give the following: (*a*) 49? (*b*) 121? (*c*) 144? (*d*) 9? (*e*) 81? (*f*) 400?

(11) If a man's income is ½d. a minute (night and day), what is the amount of his income from Monday at 8.20 A.M. to Saturday at 4.15 P.M.?

(12) A steam-engine working night and day consumes 15 cwt. of coal in 7½ hours. How many tons will it use in 100 days?

(13) Make up a sum and work it about travelling by train from your own station to London.

(14) How many persons are there in your family? Make up a sum about buying books for each one, and work it.

(15) If oranges are sold at the rate of 7 for 4d., how many can be got for £1, 17s. 8d.?

Exercise 40.—Term Tests.

A.

(1) (*a*) With compasses draw a square, each side 3 in. long.
(*b*) Show how to calculate the cost of 5 doz. yd. of linen at 1s. 1½d. per yd.
(*c*) With compasses draw a triangle with sides 3½ in., 2½ in., and 1½ in.
(*d*) If *a* stands for the length of an oblong, and *b* for the width, show how far it is round the oblong.

(2) A wheel travels 1 ft. per second. How many miles, furlongs, chains, yd., &c. will it go in 48 hours 37 min.?

(3) A franc is worth 9½d. If a litre of wine cost 1 franc, how much in British money would a kilolitre be worth?

(4) A man left £964, 11s. 10½d. to be divided equally among 37 men, 15 women, and 13 children. What did each get?

(5) 2 dozen boxes of tea each weighing 2 qr. 12 lb. 6 oz. are taken from a ton. How much remains?

(6) A field 4 chains 12 yd. long, and 3 chains 18 yd. wide is fenced with hurdles. If the hurdles cost 9d. per yd., what did it cost to fence the field?

B.

(1) (*a*) Make up a sum about spending 10s. 0d. on a holiday, and work it.
(*b*) What is the value of x in the following: $4x+3x=35$?
(*c*) By means of a circle show that $\frac{1}{4}$ of $\frac{2}{3}=\frac{1}{6}$.
(*d*) Draw a door to a scale of 1″=1 ft.

(2) Knitting-wool is bought in 4-oz. packets at 1s. 0½d. each, and sold at 1s. 5d. each. What is the profit on 50 lb.?

(3) On a road there are 45 lamps, the distance between them being 44 yd. 2 ft. How many miles, &c. does the lamp-lighter walk in going from the first to the last?

(4) A milkman starts with 25 gallons of milk. He has 28 customers who take a quart each, and 45 who take a pint each. How much milk has he after his round?

(5) A merchant bought 1 ton 15 cwt. 2 qr. of coffee. He made half of it into 2-oz. packets, and the rest into 4-oz. packets. How many packets of each did he make?

(6) A train starts from London at 7.40 P.M., and reaches Glasgow at 5.45 P.M. How many minutes does the journey take?

C.

(1) (*a*) By means of an oblong multiply 3·4 in. by 2·5 in.
(*b*) Write down a short way to find the cost of 36 pails at 5½d. each.
(*c*) Draw an oblong to show a square decimetre.
(*d*) With your compasses draw part of a circle and bisect it.

(2) A train travels 46 miles in 1 hr. 25 min. 6 sec. How long does it take the train to go a mile?

(3) A farmer supplied a dealer with turkeys at 8s. 9d. each. If the dealer paid £14, 17s. 6d. for them, how many turkeys were there?

(4) A train was made up of 25 trucks, holding 8 tons 14 cwt. 2 qr. each. If the empty trucks together weighed 36 tons 14 cwt. 2 qr., what weight did the engine pull?

(5) Make up a sum about measuring the school-yard, and work it.

(6) Work the following bill: 250 sheets of note-paper at 25 sheets for 2½d.; a gross packets of envelopes at 3½d. per packet; a gross of lead-pencils at 1s. 6½d. per doz.; 4 doz. boxes of pens at 10½d. per box.

D.

(1) (*a*) Make a triangle with sides 3 in., 2½ in., and 2 in. long.
(*b*) Show how to find the area of a triangle.
(*c*) How would you make a boy in Class II. understand the number of square inches in an oblong 8 in. long and 6 in. wide?
(*d*) Show how to find the cost of 23 books at 8½d. each.

(2) An ironmonger ordered 4 gross of spades marked at 5s. 9d. each. By taking so many he got them at the rate of £3, 0s. 0d. per dozen. What did he save?

(3) A motor-wagon makes three journeys a day for 6 days. Each time it carries 6 bales of wool, each weighing 4 cwt. 3 qr. 24 lb. What weight is carried in all?

(4) In 1912 the Huddersfield Corporation carried 15000 tons of coal on tram-wagons to 3 mills. How many tons did each mill use per week on an average?

(5) A boy had x shillings. He spent b shillings at one shop, and c shillings at another. How many shillings had he left?

(6) The wages of 22 carpenters for 30 weeks were £1650. How much did each man earn in a week?

Exercise 41.—Money Rules combined with Weights and Measures.

(1) Turnips are 3s. 4d. per cwt. What amount does a farmer get for 4 tons 15 cwt.?

(2) A milkman sells 54 gal. 2 qt. 1 pt. of milk in a week. The milk is 2d. per pint. How much does he receive?

(3) A greengrocer bought 36 bushels 2 pecks of potatoes. He gave 11d. per peck for them, and sold them at 1s. 3d. per peck. How much was gained?

(4) A factor gives £8, 8s. 0d. per cwt. for butter, and sells it at 1s. 8d. per lb. What profit does he make on a ton?

(5) A joiner is paid 9d. per hour, and works 9 hours per day. In June 1912 there were 5 Sundays. What were his wages for that month? (*He worked full time on Saturday.*)

(6) Soap is £1, 8s. 0d. per cwt. Find the price per lb., and the cost of 2 tons 3 cwt. 2 qr. at this price.

(7) An oil-merchant bought 6 casks of oil, each containing 36 gal. 6 gal. 2 qt. 1 pt. leaked out. He sold the rest at $2\frac{1}{2}$d. per pint. How much did he get for it?

(8) 54 yd. of carpet cost 6s. 7d. per yd., and were sold at 7s. 6d. per yd. What profit was made?

(9) A baker bought 2 sacks of flour, each containing 16 st. 7 lb., at 1s. 8d. per stone. From the flour he made 196 loaves, and sold them at 5d. each. What did he gain, allowing 5s. 6d. for other expenses.

(10) A coal-merchant bought 2 trucks of coal, each containing 8 tons 15 cwt., at 17s. 6d. per ton. He sold the coal at 22s. 6d. per ton. How much did he gain?

(11) A grocer bought 4 sides of bacon, weighing: 2 qr. 17 lb., 1 qr. 26 lb., 2 qr. 12 lb., and 3 qr. 1 lb. How much did the bacon cost at $7\frac{1}{2}$d. per lb.?

(12) 6 cwt. 2 qr. 18 lb. of butter cost £48, 3s. 7d. What was the price per lb.?

(13) A man works 8 hr. a day for 10 weeks of 6 days each, and earns £18, 10s. 0d. How much an hour does he earn?

(14) Make up a sum about buying oranges, and work it.

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(15) A man had 456 sheep. He sold $\frac{1}{6}$ of them, and then $\frac{1}{3}$. How many had he left?

(1) A farmer received £14, 1s. 3d. for fowls at 3s. 9d. each. How many did he sell?

(2) It requires 2 yd. 1 ft. of print to make a pinafore. How many pinafores can be made from a roll containing 130 yd. 2 ft. of print?

(3) A potato basket holds 2 pk. 1 gal. Find the number of baskets required for 40 bushels.

(4) A rail is 3 yd. 2 ft. long. How many are required to enclose a square, each side measuring 17 chains 2 ft. 9 in.?

(5) A barrel holds 4 gal. 2 qt. of oil. How many such barrels can be filled from 8 casks, each holding 36 gal.?

(6) A colliery sends out 500 tons of coal. If a wagon holds 6 tons 5 cwt., how many are required to carry the coal?

(7) How many 4-lb. packets of coffee at 1s. 9d. per lb. can be bought for £36, 15s. 0d.?

(8) It takes 3 yd. 1 ft. 6 in. of cloth to make a suit. How many suits can be made from 100 yd., and how much cloth is left?

(9) A man had 8 chains 18 yd. of wire to make a drying frame. If the frame is composed of lengths of wire each 1 yd. 1 ft. 6 in. long, how many lengths were there? How much wire was left?

(10) A wheel is 5 ft. 8 in. in circumference. How many times will it turn round in going 2 fur. 9 ch. 13 yd. 2 ft.?

(11) A yard of cloth cost 7s. 9d. How many yards can be bought for £34, 9s. 9d.?

(12) A merchant bought 8 tons 5 cwt. 2 qr. 14 lb. of potatoes. 6 cwt. 2 qr. were bad. He put the remainder into bags, each holding 9 st. 7 lb. How many bags were required?

(13) A grocer bought 6 lots of flour, each weighing 1 ton 13 cwt. 3 qr. If this was sold out in smaller bags of 1 st. 7 lb. each, how many would there be?

(14) A merchant bought a stock of gloves for £356, 19s. He sold them at 5s. 11½d. per pair, making a profit of 5½d. on each pair. How many pairs did he buy?

(15) A merchant bought 30 tons 17 cwt. 2 qrs. of wool packed in bales, each holding 6 cwt. 2 qr. How many bales were there?

(16) Make up a sum about a wheel turning round, and work it.

Exercise 43.—Division of Fractions.

(1) Draw an oblong 6 in. long and $\frac{1}{2}$ in. broad. How many strips of paper each $\frac{3}{4}$ in. long and $\frac{1}{2}$ in. broad will cover it?

(2) Draw a figure 2 inches square. Show how many $\frac{1}{3}$ sq. in. there are in it.

(3) By means of strips of paper show how often:
(*a*) $\frac{1}{2}$ in. is contained in 6 in.; (*b*) $\frac{2}{3}$ in. is contained in 6 in.;
(*c*) $\frac{3}{4}$ in. is contained in 6 in.; (*d*) $\frac{4}{5}$ in. is contained in 8 in.;
(*e*) $\frac{2}{5}$ in. is contained in 8 in.; (*f*) $\frac{2}{3}$ in. is contained in 4 in.

(4) By drawing on squared paper show how many times:
(*a*) $\frac{7}{6}$ in. is contained in 7 in.; (*b*) $\frac{5}{6}$ in. is contained in 5 in.;
(*c*) $\frac{3}{5}$ in. is contained in 6 in.; (*d*) $\frac{2}{5}$ in. is contained in 6 in.;
(*e*) $\frac{2}{3}$ in. is contained in 10 in.; (*f*) $\frac{3}{8}$ in. is contained in 6 in.

(5) Draw an oblong 5 in. long and 1 in. wide. Show (*a*) how many $\frac{1}{4}$ sq. in. there are in it; (*b*) how many $\frac{1}{2}$ sq. in. there are in it.

(6) A man had 10s. 0d. He gave $\frac{5}{8}$ of a shilling to each of a certain number of boys, and that took up all his money. How many boys were there? (*Work this by means of a strip of paper.*)

(7) A piece of string $\frac{5}{6}$ of a yard long is cut into 5 equal parts. What part of a yard is each piece?

(8) Show by drawing lines, how often (*a*) $\frac{4}{5}$ in. is contained in 4 in.; (*b*) $\frac{6}{8}$ in. in 6 in.; (*c*) $\frac{3}{4}$ in. in 9 in.

(9) Draw an oblong 4 in. by 3 in., and show how many strips $\frac{3}{8}$ in. wide and 4 in. long can be cut from it.

(10) Find the answers to the following by means of strips of paper: (*a*) $3\frac{3}{4}$ shared into 5 equal parts; (*b*) $2\frac{7}{10}$ shared into 3 equal parts; (*c*) $4\frac{4}{5}$ shared into 6 equal parts; (*d*) $5\frac{5}{8}$ shared into 5 equal parts.

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(11) If the price of 4 lambs is £4, 18s. 8d., what is the price of 57 lambs?

(12) A boy walks 2 miles in 40 minutes, and takes 288 steps in a minute. How many inches long is each step?

(13) If I planted shrubs by the side of a walk 58 yd. 1 ft. long, and the shrubs were 2 ft. 6 in. apart, and were so arranged that there was a shrub at each end of the walk, how many of them should I need?

(14) Make up a sum about measuring, and work it.

Exercise 44.—Square Measure—I.

(1) Draw figures to show: (*a*) **10** sq. in.; (*b*) **15** sq. in.; (*c*) **3** in. square; (*d*) **3** sq. in.

(2) Draw a figure **3** inches square and another **4** inches square. Draw a square containing the same number of square inches as both these.

(3) Letting half an inch stand for **1** inch, draw a square to show how many square inches there are in **1** sq. ft.

(4) Letting **2** inches represent a foot, draw a square to show how many sq. ft. there are in a sq. yd.

(5) Letting **6** in. represent a yd., draw a figure to show half a sq. yd., and another to show half a yd. square.

(6) Letting half an inch stand for **1** inch, draw an oblong to show a square foot.

(7) Draw a figure to show how many bricks **9** in. long and **4½** in. wide are required to cover a sq. yd. Let **6** in. stand for a yd.

(8) Letting half an inch stand for **1** inch, draw three oblongs of different dimensions, each containing a square foot.

(9) Letting **6** in. stand for a yard, draw **2** triangles, one containing half a sq. yd., and the other a quarter of a sq. yd.

(10) Draw a figure to show how many blocks of wood each **9** in. square are required to cover a sq. yd.

(11) Draw a figure to show a sq. decimetre.

(12) Letting a cm. represent a dm., from the figure in (11) show how many sq. dm. there are in a sq. metre.

(13) Hence, make up and write out the table for square measure in the Metric System.

(14) Measure your table at home. Draw a plan of it, and put the dimensions on the plan.

(15) Make up a sum about the size of your bed.

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(16) If a draper sells **36** pieces of bleached calico, each **21** yd. **2** ft. **6** in. long, at **9**d. per yd., how much does he receive?

(17) If you buy **36** gallons of oil at **1**s. **3½**d. per gallon, and sell it at **2½**d. a pint, what do you gain?

(18) In a church collection there were **17** half-crowns, **26** florins, **38** shillings, **60** sixpences, **119** threepenny-pieces, and **250** pennies. Find the total.

Exercise 45.—Square Measure—II.

(1) Find the area of a floor 8 yd. 2 ft. long and 5 yd. wide. Work the sum as follows:

Length of floor = 8 yd. 2 ft., or 26 ft.
Width of floor = 5 yd., or 15 ft.
Area of room = (26 × 15) sq. ft.
Area of room = 390 sq. ft., or 43 sq. yd. 3 sq. ft.

(2) How many sq. ft. are there in a full-sized football field 120 yd. long and 80 yd. wide?

(3) A tablecloth contains 176 sq. ft. 64 sq. in. How many sq. in. are there in it?

(4) A leaf of a book is 7 in. long and 4 in. wide. How many sq. ft. and sq. in. will 56 leaves cover?

(5) A floor 26 ft. long and 22 ft. wide is covered with blocks of wood, each 6 in. square. How many blocks are there?

(6) A floor is 13 ft. 6 in. long and 11 ft. wide. How many sq. ft. and sq. in. are there in it?

(7) A floor 18 ft. long and 15 ft. wide is covered with carpet at 7s. 6d. per sq. yd. Find the cost of the carpet. (*Work this sum in* 2 *ways.*)

(8) A wall is 6 ft. high and 120 yd. long. What is the total cost of building the wall at the rate of 2s. 6d. per sq. yd.?

(9) The gable end of a house is 30 ft. wide. The height to the ridge of the roof is 46 ft., and the height to the eaves is 38 ft. What does the gable end cost for plastering at 3d. per sq. ft.? (*Draw a plan.*)

(10) A newspaper contained 4 sheets, each 4 ft. long and 2 ft. 6 in. wide. What space would all the sheets cover?

(11) The ceiling of a room is 18 ft. 6 in. long and 16 ft. wide. What is the cost of papering it at 7d. per sq. ft.?

(12) Flagstones are 3s. 6d. per sq. yd. What will it cost for sufficient to make a causeway 65 yd. long and 9 ft. wide?

(13) Make up a sum about the area of the school-yard, and work it.

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(14) An oil-merchant had in stock 498 pints of oil. If he sells $\frac{1}{6}$ of his stock, and then $\frac{1}{2}$, how many gallons has he left?

(15) I buy $2\frac{1}{2}$ cwt. of cheese for £5, 16s. 8d., and sell it so as to gain $2\frac{1}{2}$d. per pound. Find the selling price per pound.

(16) What is the seventy-eighth part of 7208 yd. 1 ft. 6 in.?

Exercise 46.—Multiplication of Money—Aliquot Parts.

(1) Find the cost of 85 tons of charcoal at £4, 5s. 0d. per ton.

(2) On a certain date foreign flour was 10s. 10½d. per cwt. What would 5 tons 15 cwt. cost?

(3) Foreign wheat was 7s. 7½d. per cwt. How much was paid for 6 tons 14 cwt.?

(4) Find the price of 350 gal. of engine oil at 3s. 9d. per gal.

(5) A draper bought 6 pieces of woollen delaine. Each piece was 56 yd. long. What did it cost at 1s. 4½d. per yd.?

(6) What does a wool-merchant pay for 504 lb. of Lincoln wool at 5¾d. per lb.?

(7) A grocer bought a ton of raisins at £2, 16s. 0d. per cwt. He sold them at 7½d. per lb. What was his profit?

(8) A draper bought 1 gross pairs of gloves at 1s. 11½d. per pair. What did he pay for them?

(9) What did a grocer pay for 3 cwt. of tea at 2s. 6½d. per lb.?

(10) Find the cost of 5 tons 16 cwt. of butter at £5, 6s. 8d. per cwt.

(11) A merchant bought 120 cases of Jaffa oranges at 9s. 6d. per case. What did he pay for them?

(12) One market-day American bacon was £2, 3s. 4d. per cwt. What would a wholesale provision-dealer have to give for 4 tons 18 cwt.?

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(13) How many minutes are there from 4.42 A.M. to 5.18 P.M.?

(14) A grocer bought 10 cwt. of raisins at £2, 2s. 0d. per cwt. He sold half of them at 5d. per lb., and the other half at 5½d. per lb. What did he gain?

(15) A merchant bought 4800 eggs at the rate of 120 for 7s. 9d. What did they cost?

(16) A grocer bought 1 cwt. 2 qr. 5 lb. of cheese for £5, 8s. 1½d., and sold it so as to gain 1¾d. on each lb. Find the selling-price per lb.

(17) In a race of two thousand yards, the winner gave the second man a start of 58¾ yd., and beat him by 14 yd. 1 ft. 6 in. How far did the second man run while the winner was running the whole distance?

(18) Make up a weekly bill about the groceries for your family, and work it.

Exercise 47.—Triangles.

(1) On thin cardboard draw an isosceles triangle with sides 3″ long and base 2″ long, and cut it out. Now draw a line, and make a dot near the middle of it. Place each angle of the triangle on the dot, and mark out the angle. Write down the size of the two equal angles, and of the third angle.

(2) Draw an isosceles triangle with sides 6·5 cm. long and base 4·2 cm. long. Measure the size of the angles with the protractor, and write down the sum of the equal angles.

(3) Draw an isosceles triangle, and mark the angles A, B, C.
(*a*) Find the size of A, if B and C are 40° each;
(*b*) Write down the sum of all the angles.

(4) If A, B, and C are the angles of a triangle:
(*a*) Find A when B = 60° and C = 45°;
(*b*) Find B when A = 45° and C = 75°;
(*c*) Find C when A = 30° and B = 80°;
(*d*) Find the sum of A and B when C = 35°;
(*e*) Find the sum of A, B, and C when they are all the same size.

(5) Draw an equilateral triangle with each side 3·5 in. long. By means of tracing-paper and protractor show that the angles are all the same size.

(6) Draw three equilateral triangles with sides (*a*) 2·6 in. long, (*b*) 7·5 cm. long, and (*c*) 5·6 cm. long. Write down what you notice about all the angles of these triangles.

(7) Draw a triangle with sides 3·5 in., 2·6 in., and 2·1 in. Measure the angles, and write down the position of the largest angle and of the smallest.

(8) Draw a triangle, each side of a different length. Find the length of each side and the size of each angle.

(9) Draw a line 3″ long. At each end make angles of 75° and 30°, and complete the triangle. Give the size of the remaining angle, and find the length of the other two lines.

(10) Draw a triangle with two sides 3·6 in. and 2·5 in. long, and the angle between them 65°. Find the length of the other side and the size of the remaining angles.

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(11) A man drank every day a pint of beer which cost 7d. a quart. What would he save in a month of 31 days if he gave up drinking beer?

(1) A picture is 2 ft. 9 in. long and 2 ft. 2 in. wide; it has a frame round it 2″ wide. Draw the picture and its frame to a scale of 1″ to a ft.

(2) A blackboard is 4 ft. 9 in. long and 3 ft. 8 in. wide. Draw a plan of it to a scale of 1″=1 ft.

(3) Make a scale showing 1″=10 ft. By means of this scale draw a line 65 ft. long.

(4) On page 3 of cover is the drawing of a class-room door. Draw the plan to a scale of 1″=1 ft.

(5) On page 3 of cover is a hand-sketch of a cupboard door. Draw a plan of it to a scale of 1″=1 ft.

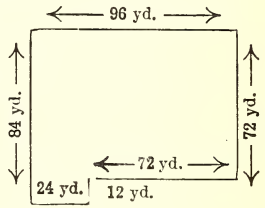
(6) On page 3 of cover is a hand-sketch of the front of a desk. Draw a plan of it to a scale of 1″=1 ft.

(7) On page 3 of cover is a hand-sketch of the back of a teacher's desk. Draw a plan of it to a scale of 1″=1 ft.

(8) On page 3 of cover is the side view of a piano. Draw a plan of it, using a scale of 1″=1 ft.

(9) A class-room is 25 ft. 6 in. long and 23 ft. 6 in. wide. Draw a plan of it to a scale of $\frac{1}{4}$″=1 ft.

(10) The sketch represents a playground. Draw it to a scale of $\frac{1}{12}$″=1 yd.



(11) Make a sketch of a door in your house. Measure each part, and draw a plan of it to a scale of $\frac{1}{2}$″=1 ft.

(12) Make a sketch of the front of the cupboard in your class-room. Write the measurements on the sketch, and draw a plan of the cupboard to a scale of 1″=1 ft.

(13) The end of a house is 25 ft. wide and 28 ft. high to the spouting. The roof is 10 ft. high. Draw a plan of the end to a scale of $\frac{1}{10}$″=1 ft.

(14) There are 16 ft. of iron railings in front of a house. The rails are 4 ft. high and 6″ apart, and an iron bar going the whole length is 6″ from the top. Draw a plan of these; $\frac{1}{4}$″=1 ft.

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(15) What number multiplied by 85 will give the same result as 13770÷27?

(16) Multiply the sum of 7s. 8$\frac{1}{4}$d. and 12s. 1$\frac{1}{2}$d. by ninety-three.

(1) Work the following sums on squared paper:
(*a*) 6·6 in. ÷ 3; (*b*) 7·2 in. ÷ 4; (*c*) 8·4 inches ÷ 6.

(2) Do the following sums with string:
(*a*) 2·65 metres ÷ 5; (*b*) 1·84 metres ÷ 4.

(3) Draw a line 5 inches long. Write down its length in centimetres, and find how many cm. there are in one inch.

(4) The total height of 6 boys was 74·76 dm. What was the average height?

(5) 7 boys weighed the following: 6·5 stones, 7·2 stones, 8·5 stones, 5·75 stones, 6·5 stones, 4·75 stones, and 6·23 stones. What was the average weight?

(6) Five trucks contained 37·2 tons of coal. What was the average weight in one truck?

(7) Twelve beams, each the same size, weighed 43·68 tons. What was the weight of each?

(8) Fasten a coloured strip of paper, 7·8 inches long, in your exercise-book, and show how many times 1·3 in. can be cut off from it.

(9) What is the eighth part of £9·76?

(10) Draw a line 8·1 inches long, and show how many times ·9 inches can be taken from it.

(11) With coloured paper show how many times 3·6 cm. can be taken from 1·8 dm.

(12) By using a coloured strip of paper show how often 1·8 in. can be taken from 7·2 in.

(13) By means of a piece of string show how often 1·4 dm. is contained in 2·8 metres.

(14) A room is 7·5 metres long. Letting a centimetre stand for a metre, by drawing a line show how many pieces of string each 1·5 metres long will be required to reach from one end to the other.

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(15) How many 4-oz. packets of tea can be made from 16 chests, each holding 56 lb.?

(16) How many times can a man take 8s. 6d. out of a bag containing £98, 12s.?

(17) How many minutes are there from 8.45 A.M. on Monday to 3.40 P.M. on Friday?

(18) Make up a sum about sharing £8·7, and work it.

Exercise 50.—Introduction to Cubic Measure—Practical.

(1) Examine a cubic inch of wood, and write down all you observe about it.

(2) Draw a three-inch square, and on it build up a three-inch cube with inch-cubes. Write down how many rows there are in a layer, and the number of layers.

(3) Arrange inch-cubes so as to show **12** cubic inches.

(4) Cut out in cardboard a box **6** in. long, **4** in. wide, and **2** in. deep. Fill it with inch-cubes, and write down:
Number of cubes in a row $= a$.
Number of rows in a layer $= b$.
Number of cubes in a layer $= a \times b$.
Number of layers in box $= c$.
Number of cubes in box $= a \times b \times c = abc$.

(5) Make a **3**-in. cubic box, and write down how many inch-cubes will fill it, proceeding in the way given in (4).

(6) A bar of soap is **6** inches long, **2** inches wide, and **2** inches thick. Write down (as in 4) the number of cubic inches there are in it.

(7) A fire-brick is **8** inches long, **4** inches wide, and **3** inches thick. How many cubic inches are there in it?

(8) A tank is **8** ft. long, **6** ft. wide, and **6** ft. deep. How many cubic ft. of water will it hold?

(9) A beam is **4** feet long and **9** inches square. Find how many cubic inches it contains.

(10) A stone for the bed of an engine is **7** feet long, **4** feet wide, and **3** feet thick. How many cubic feet are there in it?

(11) What will the stone cost at **3**s. **6**d. per cubic foot?

(12) To make a ruler, a boy starts with a piece of wood **20** cm. long and **2** cm. square. How many cubic cm. are there in it?

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(13) A man spent **4** hr. **38** min. in travelling from London to York, and twice as long in travelling from York to Inverness. How many minutes would he spend in going from London to Inverness and back again?

(14) A hogshead contains **54** gallons. After taking away **17** quarts, how many half-pints remain?

(15) Make up a sum about the measurement of a box, and work it.

Exercise 51.—Graphic Arithmetic.

(1) In 10 cricket matches a boy made the following scores: 12, 7, 18, 22, 5, 0, 14, 19, 15, 8. Show these scores by means of a graph.

(2) In a class the number of boys present each half-day for a week was as follows: 34, 36, 32, 38, 31, 35, 37, 30, 33, 29. Show this by means of a graph.

(3) A man's wages begin at 30s. per week. He receives an increase of 3s. 0d. per week each year for 10 years. Show on a graph how much he earns at the beginning of the tenth year.

(4) A cricket team plays 20 matches in a season, and makes the following runs: 38, 25, 50, 18, 36, 44, 39, 18, 36, 49, 14, 60, 65, 32, 84, 72, 40, 14, 45, 37. Show these by means of a graph.

(5) A baby is weighed every month. The weights are as follows: 1st month, 8 lb.; 2nd, 10 lb.; 3rd, $11\frac{1}{2}$ lb.; 4th, $12\frac{1}{2}$ lb.; 5th, 14 lb.; 6th, $15\frac{1}{2}$ lb.; 7th, 17 lb.; 8th, 18 lb.; 9th, 20 lb.; 10th, 21 lb.; 11th, 22 lb.; 12th, $23\frac{1}{2}$ lb. Draw a graph to show the increase.

(6) Eggs are sold at these prices: Jan., 6 for 1s. 0d.; Feb., 8 for 1s. 0d.; March, 10 for 1s. 0d.; April, 12 for 1s. 0d.; May, 11 for 1s. 0d.; June, 12 for 1s. 0d.; July, 13 for 1s. 0d.; Aug., 12 for 1s. 0d.; Sept., 10 for 1s. 0d.; Oct., 8 for 1s. 0d.; Nov., 7 for 1s. 0d.; Dec., 6 for 1s. 0d. Illustrate by a graph the changes in price during the year.

(7) For 10 days in March the following were the rainfall readings in the school-yard: ·1 in., ·5 in., 0 in., ·8 in., ·12 in., ·3 in., ·15 in., ·2 in., ·7 in., ·15 in. Draw a graph to show these.

(8) The sunshine record during 10 days in July was as follows: 12 hr., $11\frac{1}{2}$ hr., 8 hr., 14 hr., 6 hr., 10 hr., $9\frac{1}{2}$ hr., 3 hr., $6\frac{1}{2}$ hr., 13 hr. Show these variations on a graph.

(9) Notice the number of spellings you get right each writing lesson during a week, and draw a graph to show them.

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(10) A roll of cloth is 120 yd. 4 in. long. If 60 yd. 2 ft. are cut off, and then 50 yd. 6 in., how much is left?

(11) Each of 15 men spent 7 hr. 45 min. over a certain job. If the working day is 10 hours, how many working days were spent in all?

(1) A room is **24** ft. **6** in. long and **18** ft. wide. All round the room is a painted border **1** yd. wide. Find the area of carpet required for the unpainted part.

(2) The playing part of a football field is **180** yd. long and **90** yd. wide. Round this is a space **3** yd. wide. Find the area of the part outside the playing area.

(3) A causeway is **180** yd. long and **6** ft. wide. If it is made of concrete flags each **2** ft. **6** in. long and **2** ft. wide, how many flags were needed?

(4) The floor of a corridor is covered with tiles, each **9** in. square. The corridor is **6** yd. long and **2** yd. wide. What is the cost of the tiles at **4**d. each?

(5) The roof of a wooden shop is **18½** ft. long and **10** ft. wide. What is the cost of the roof at **1**s. **6**d. per sq. yd.?

(6) An oblong grass-plot is **24** yd. long and **18** yd. wide. All round the outside is an asphalt path **3** ft. wide. What was the cost of asphalting the path at **2**s. **6**d. per sq. yd.?

(7) A space **9** yd. long and **7** yd. wide was paved with bricks placed sideways. If the bricks were **9** in. long and **3** in. thick, how many were required?

(8) A room **24** ft. long and **22** ft. wide is boarded round with pitch-pine boards **6** in. wide. How many boards were required?

(9) An oblong lawn is **24** yd. long and **18** yd. wide. In it are three flower-beds, each **4** ft. square. What is the area of the part covered with grass?

(10) How many planks each **16** ft. long and **9** in. wide are required for a platform **15** yd. long and **8** yd. wide?

(11) A class-room is **25** ft. long and **22** ft. wide. If each pupil is allowed **10** sq. ft. of floor space, for how many pupils is the room built?

(12) What is the cost of paving a street **64** yd. long and **10½** ft. wide at **14**s. **6**d. per sq. yd.?

(13) Make up a sum about covering a floor with oilcloth, and work it.

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(14) A man buys butter at **11½**d. per lb., and sells it at **1**s. **4**d. per lb. Find his gain on the sale of $\frac{3}{4}$ cwt.

(15) A man's income is **200** guineas a year, and he spends **£2**, **18**s. **4**d. per week. What does he save in a year?

Learn:

(*a*) If equals are added to equals, the wholes are equal.
(*b*) If equals are taken from equals, the remainders are equal.
(*c*) If equals are multiplied by the same number, the products are equal.
(*d*) If equals are divided by the same number, the quotients are equal.

(1) Find the value of x in the following:

1. $x+18=24$.
2. $x+15=42$.
3. $x+17=28$.
4. $x+18=29$.
5. $x-12=14$.
6. $x+17=36$.
7. $x+19=27$.
8. $x+12=44$.
9. $x+14=56$.
10. $x-16=21$.

(2) What is the value of x in the following:

1. $2x+8=24$.
2. $4x+9=37$.
3. $3x+6=27$.
4. $4x+15=55$.
5. $3x-8=28$.
6. $4x-9=27$.
7. $6x-12=48$.
8. $2x-12=36$.
9. $5x-12=33$.
10. $7x-16=54$.

(3) The side of a square is x inches long, and the perimeter is 48 inches. How long is x?

(4) Each side of an equilateral triangle is x inches long. The perimeter is 24 inches. What does x stand for?

(5) A boy said, 'I have $3x$ marbles and 2 marbles more, and my brother has 38.' If each had the same number of marbles, what did x stand for?

(6) An oblong is $2x$ inches long and x inches broad. If the perimeter is 48 inches, how many inches broad is the oblong?

---

(7) From a roll of muslin $90\frac{3}{4}$ yards long a piece 11 yd. 1 ft. 9 in. long is cut off, and the rest is used in making 19 children's dresses of equal size. How much is used for each dress?

(8) A train travels at the rate of 44 miles an hour. How far will it run between 8.30 A.M. and 1.20 P.M., allowing 35 minutes for stoppages on the way?

(9) On taking stock a draper found that of a certain roll of calico only one-fourteenth was unsold. If the roll, when new, contained 49 yards, how many yards had been sold?

(10) Make up a sum about x, and work it.

Make out the following bills:

(1) 9 lb. of mutton at 9½d. per lb.; 7½ lb. of beef at 10d. per lb.; 10 lb. of veal at 10½d. per lb.; 11 lb. of pork at 11½d. per lb.

(2) 15 yd. of cloth at 6s. 6½d. per yd.; 14 umbrellas at 11s. 9½d. each; 1½ doz. collars at 7½d. each; 4 ties at 10½d. each; 2 pairs of gloves at 3s. 11d. per pair.

(3) ½ cwt. of cheese at 7½d. per lb.; 2 stones of bacon at 8½d. per lb.; 1 cwt. of sugar at 2½d. per lb.; 1 doz. boxes of sardines at 10½d. each.

(4) 16 brushes at 2s. 11d. each; 3 doz. pails at 5½d. each; 18 brooms at 3s. 9d. each; 4 doz. handles at 4½d. each.

(5) 36 gal. of paraffin-oil at 9½d. per gal.; 40 gal. of olive-oil at 4s. 9d. per gal.; 54 gallons of sweet-oil at 2s. 5d. per gal.; 18 gal. of linseed-oil at 3s. 4d. per gal.

(6) 2 gross of lead-pencils at 9d. per doz.; 4 doz. boxes of pens at 4½d. per box; 3 doz. bottles of ink at 4¼d. per bottle; 2000 envelopes at 9½d. per 100.

(7) 8 tons of coal at 15s. 8d. per ton; 12 tons of best coal at 24s. 9d. per ton; 3 tons of slack at 8d. per cwt.; 25 sacks of coke at 11½d. per sack.

(8) 10 lb. 4 oz. of eels at 1s. 2d. per lb.; 9 lb. of salmon at 1s. 10d. per lb.; 4 lb. 12 oz. of halibut at 1s. 4d. per lb.; 9 lb. 8 oz. of sole at 1s. 10d. per lb.

(9) 1½ cwt. of nails at 1½d. per lb.; 7 dozen packets of screws at 7½d. per packet; 3 dozen locks at 1s. 10½d. each; 6 doz. window racks at 1½d. each; 4 doz. barrel bolts at 3½d. each.

(10) What is left out of £20 after paying the following bill:
2 cwt. of potatoes at 11½d. per stone; 1 cwt. of plums at 5½d. per lb.; 4 cwt. of apples at 2s. 8d. per stone; 6 stones of grapes at 1s. 11d. per lb.?

(11) Make out a weekly grocer's bill for your own family, and work it.

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(12) A man paid away in wages the sum of £39, 18s. 7½d. every week. What did he pay away in 89 weeks?

(13) A man works 9 hr. 40 min. every day for five days of the week, and half that time on Saturday. During how many hours per week, including Sunday, is he not working?

(1) Iron nails are £4, 6s. 8d. per ton. What is the cost of 555 tons?

(2) A draper buys cloth at 2s. 9¾d. per yd. How much does he pay for 648 yd.?

(3) In a week a coal-merchant spends £558. He buys 56 trucks of coal, each holding 8 tons, at 16s. 9d. a ton, and spends the rest on wages. Find the wages bill.

(4) A grocer bought 70 boxes of raisins at 4¼d. per lb. Each box contained 45 lb. What did he pay for them?

(5) A merchant bought a ton of coffee for £158, 13s. 4d. What was the cost per lb.?

(6) A contractor buys 75,000 bricks at 36s. per 1000, and 125 sq. yd. of flags at 3s. 11½d. per sq. yd. What amount does he pay altogether?

(7) A draper had £268, 19s. 10d. in hand. He paid for 150 yd. of flannel at 1s. 2d. per yd., and his takings for the week were £368, 17s. 4d. How much money had he at the end of the week?

(8) A butter-factor bought 3 cwt. of butter at £5, 16s. 0d. per cwt., and when selling it gained £4, 6s. 0d. on the whole. What was the selling price per lb.?

(9) A grocer bought 3 cheeses, each weighing 68 lb. He sold them for £5, 4s. 6d., thus losing 6s. 0d. What did the cheese cost him per lb.?

(10) A wool-merchant bought 590 lb. of wool at 1s. 6½d. per lb. He sold it at a gain of ¾d. per pound. What amount did he get for the whole?

(11) 3 boxes of soap contained 1 cwt. 50 lb. each. Find the total value, if the soap is worth 3½d. per lb.

(12) Nails are 18s. 6d. per cwt. If they are sold at 3½d. per lb., what is the gain on 10 cwt.?

(13) A merchant sold a quantity of coffee at 1½d. per ounce for £90, 11s. 4½d. How much coffee did he sell?

(14) A man bought ½ cwt. of tea at 1s. 6½d. per lb., and sold it at the rate of 2 lb. for 3s. 6d. What did he gain?

(15) If 35 tons of potatoes cost £81, 13s. 4d., find the cost of 1 cwt.

(16) Find the cost of 3381 copy-books at 1½d. each.

(17) Make up a sum about buying boots, and work it.

(1) How many lb. of sugar at $3\frac{1}{2}$d. per lb. can be bought for thirty guineas?

(2) A farmer exchanged **57** sheep worth £2, 12s. 6d. each for **105** pigs. How much was each pig worth?

(3) A sack of potatoes weighs **168** lb. How many tons, &c., are there in a truck-load containing **84** sacks?

(4) Two loads of hay together weighed **1** ton **18** cwt. **2** qr. **8** lb. If a truss weighs **2** qr. **4** lb., how many trusses were there in the loads?

(5) **7** yd. **1** ft. **6** in. of cloth will make a dress. How many dress-pieces can be cut from **4** rolls of cloth, each measuring **45** yd.?

(6) What is the amount of the following bill: **1** sack of flour containing **9** stones at 1s. 4d. per st.; $2\frac{1}{2}$ stones of sugar at $2\frac{1}{2}$d. per lb.; **10** lb. of oatmeal at 2s. 4d. per st.; **6** lb. of ham at 1s. $1\frac{1}{2}$d. per lb.?

(7) (*a*) £1·35 + £2·98 + £3·8 + £3·75;
(*b*) $1\frac{3}{5}$ in. + $2\frac{1}{10}$ in. + $3\frac{1}{2}$ in.; (*c*) $3\frac{1}{3}$ in. − $1\frac{3}{5}$ in.;
(*d*) 3·65 m. + 2·37 dm. + ·65 cm. + 3·42 m.;
(*e*) Give as decimals: $\frac{3}{4}$, $\frac{7}{10}$, $1\frac{3}{5}$.

(8) In **1901** the population of Liverpool was **704134**, and of Manchester **644873**. In **1911** Liverpool had **746566** people, and Manchester **714427**. What was the increase in each city?

(9) School starts at **9** A.M. and ends at noon. It begins again at **2** P.M. and finishes at **4.30** P.M. How many minutes does a boy spend in school who attends a full week?

(10) A man employs **12** masons, and pays them $9\frac{1}{2}$d. per hour. What is the wages bill for a week, if they work $9\frac{1}{2}$ hr. per day for **5** days and $5\frac{1}{2}$ hr. on Saturday?

(11) Linoleum costs 3d. per sq. ft. What does it cost to cover two floors each **6** yd. long and **5** yd. wide?

(12) Pipes for draining land are 2s. 9d. per **100**. What does a farmer pay for **4500**?

(13) A contractor spent £57, 3s. 9d. in buying spades at 3s. 9d. each. How many did he buy?

(14) A man owns **14** houses. The rent of each house is 5s. 6d. per week. What is the total rent for **1** year?

(15) A cyclist travelled **36** m. in **2** hr. **35** min. **24** sec. What was his average time per mile?

Exercise 57.—Miscellaneous Exercises.

(1) A plumber has to put in **54** windows, each **2** ft. long and **1** ft. **6** in. wide. Find the cost at **1**s. **2**d. per sq. ft.

(2) **48** carriage axles of the same size weigh **7** tons **12** cwt. **2** qr. **8** lb. What is the weight of each?

(3) How many **2**-in. cubes can be cut from a plank **6** ft. long, **8** in. wide, and **4** in. thick?

(4) At a sale the following is fastened on a piece of dress material: 'Reduced from **2**s. **11**d. per yd. to **2**s. **5½**d.' If a woman buys **2** dozen yards, what is the amount saved?

(5) A draper buys socks at **10**s. **6**d. per dozen pairs, and sells them at **1**s. **4½**d. per pair. What does he gain by selling **6** dozen pairs?

(6) A boy's hoop goes **1** ft. **4** in. in turning round once. How many times does it turn round in going a mile?

(7) A farmer supplies eggs at **10**d. per dozen. These are sold by the grocer at **10** for **1**s. **0**d. What does the grocer gain on **65** dozen eggs?

(8) A stack of hay weighs **37** tons **10** cwt. If a farmer uses **2** cwt. **2** qr. per day, how many weeks will the hay last?

(9) A boy divided a sum of money by **87**. His answer was £**5**, **18**s. **7½**d., and **35** farthings over. What was the sum of money?

(10) A coal-truck when empty weighs **14** cwt. **2** qr.; when full, it holds **6** tons **15** cwt. of coal. If an engine takes away **26** full trucks, what weight does it pull?

(11) A joiner bought **6** boards each **10** ft. **6** in. long, **5** each **3** yd. **2** ft. long, and **4** each **16** ft. **4** in. long. How much did they cost him at **9**d. per ft.?

(12) A boy said, 'I have x marbles and my brother has $3x$ marbles.' How many had one boy more than the other?

(13) Five pieces of string measure respectively **58** yd. **2** ft. **10** in., **39** yd. **1** ft. **8** in., **74** yd. **6** in., **130** yd. **2** ft., and **186** yd. **1** ft. **11** in. Find the total length.

(14) Between **8.50** A.M. and **2.26** P.M. a clerk copied **18** sheets of foolscap. How long was that for each sheet?

(15) Two new half-crowns weigh exactly **1** oz. Find the weight (in cwt. qr. lb. etc.) of £**876**, **7**s. **6**d. worth of new half-crowns.

(16) Make up a sum about buying note-paper, and work it.

(1) My garden is square, each side measuring 37 yd. 6 in. Each side of my neighbour's garden is 1 ft. 8 in. longer than that. If I walk round my neighbour's garden seven times, what distance do I walk?

(2) Sound travels 1120 feet per second. Thunder is heard 13 sec. after lightning is seen. How far is the storm away?

(3) There are 480 yd. of paper on a roller. It takes $\frac{1}{2}$ yd. to make one envelope. If 30 envelopes are made in a minute, how long will the roll of paper last?

(4) At Christmas a lady gave 2 cwt. of coal and 4 lb. of cheese to each of 50 old people. If the coal cost 19s. 6d. per ton and the cheese 9d. per lb., find the total cost.

(5) Lead-pencils are sold at 1d. each. If a stationer buys them at 8d. per dozen, what profit does he get on 2 dozen gross?

(6) A wool-merchant bought 2 cwt. 2 qr. of wool at 2s. $1\frac{1}{2}$d. per lb. When sorted, half was sold at 3s. 3d. per lb., and the rest at 1s. 10d. per lb. How much per lb. did he gain?

(7) A game of bowls cost 2d. The takings from a bowling-green in June were £7, 14s. 6d., and in July £8, 9s. 4d. How many games in all were played in these months?

(8) On a wagon there are 6 sets of boxes, and each set consists of 3 rows, with 4 boxes in a row. If each box weighs 56 lb., what weight is there on the wagon?

(9) What is the largest amount of money less than £136, 13s. $8\frac{1}{4}$d. which can be divided by 52 exactly?

(10) A tea-merchant makes up $\frac{3}{4}$ cwt. of tea into an equal number of 1-lb. and $\frac{1}{2}$-lb. packets. How many packets does he make altogether?

(11) A merchant bought 24 gallons of spirits at 18s. 0d. per gallon. After adding 6 gallons of water, at what price per pint must he sell the mixture to gain 8 guineas?

(12) A father and son together earn two guineas a week. If the father earns six times as much as the son, how much will each earn in 26 weeks?

(13) The front wheel of a carriage is 1 yd. 2 ft. 6 in. in circumference; the circumference of the back wheel is $2\frac{1}{2}$ times that. How far does the carriage travel while the back wheel turns round 88 times, and how many times does the front wheel turn round in the same time?

Exercise 59.—Examination Tests.

A.

(1) (*a*) (i) Draw a right-angled triangle. (ii) Show 12 sq. in.
(*b*) Look at the window in your class-room. When you have formed an opinion as to its size, draw a plan of it to a scale of 1″ to 1 ft.
(*c*) Show by means of an oblong $\frac{1}{3}$ of $\frac{1}{2}$.
(*d*) Write out a sum about what you can do with 10s. 0d.

(2) How many cubic inches are there in a plank 16 ft. long, 11 in. wide, and 3 in. thick?

(3) A clock ticks once each second. How often does it tick from 3.45 A.M. to 5.20 P.M.?

(4) A farmer sold 239 lambs at £1, 19s. 9d. each. With some of this money he bought 18 tons of turnips at £4, 9s. 6d. per ton. How much had he then?

(5) A draper had 3 balls of string, each 250 yd. long. How many pieces 2 yd. 1 ft. 6 in. can be cut from them?

(6) A sack of rice containing 240 lb. was bought for £4, 5s. 0d. Find the price per lb. in a short way.

B.

(1) By means of coloured strips of paper show how often (*a*) $\frac{2}{3}$ in. is contained in 8 in.; (*b*) 1·2 in. is contained in 6 in.
(*c*) Make a triangle, having one angle 45°, and two sides $2\frac{1}{2}$ in. and 3 in. long.
(*d*) Wheat is $1\frac{1}{2}$d. per lb. Write down how to find the cost of a sack containing 240 lb.

(2) A farmer sold 24 tons 15 cwt. of potatoes at 4s. 3d. per cwt. The carriage cost £6, 10s. 8d. What did he get for the potatoes after paying the carriage?

(3) A ship starts from Liverpool at 2.15 P.M. on Monday, and arrives in New York at 6.35 P.M. on the following Sunday. How many minutes did the journey take?

(4) A bowling-green is 40 yd. square. There is a path round it 6 ft. wide. Draw a plan, and find the area of the path.

(5) Make up a sum about the butter used in a French workman's family during a year, and work it.

(6) Work the following bill: 16 barrels of apples at 11s. 3d. per barrel; 14 cases of oranges at 8s. $1\frac{1}{2}$d. per case; 24 sacks of potatoes at 5s. 8d. per sack; 2000 eggs at 50 for 3s. 8d.

C.

(1) (*a*) By means of an oblong show how often ·8 in. is contained in 2·4 in.
(*b*) With compasses bisect a line 2·6 in. long.
(*c*) Draw a sketch of the front of a cupboard door, and put on what you think the dimensions are.
(*d*) By means of a protractor draw an equilateral triangle.

(2) Cotton cord is 2s. 1d. per lb. 14 skeins are made from 1 lb. and sold at $2\frac{1}{2}$d. per skein. What profit is made on 10 lb.?

(3) 70 bushels of wheat cost £22, 17s. 11d. Find the price per bushel.

(4) A milkman delivers $2\frac{1}{2}$ pints of milk daily at a certain house. How many gallons does he deliver during the months of July and August?

(5) It takes 3 yd. 9 in. of material to make a skirt. How many skirts can be made from 3 pieces of cloth each 60 yd. 2 ft. long?

(6) Make up a sum about spending £5, 0s. 0d, and work it.

D.

(1) (*a*) Show by drawing a line $\frac{1}{4}$ of $\frac{1}{3}$.
(*b*) Show by a drawing the number of square inches in a figure 9 in. long and 6 in. wide.
(*c*) If $\frac{1}{4}$ in. stands for 3d., draw a line to show 7s. 6d.
(*d*) Cheese is 9d. per lb. Give two ways of finding the cost of 23 lb.

(2) A man was paid 9d. per hour. He worked $8\frac{1}{2}$ hours a day, and 6 days a week. How much would he lose if he were out of work 8 weeks?

(3) Find the area in square inches of a grass-plot 9 ft. long and 2 ft. 6 in. wide.

(4) 36 telegraph-posts are placed at equal distances along a road 7 fur. 1 ch. 13 yd. long. What is the distance from one post to the next?

(5) From London to Brighton is 50 miles. If the average speed of a motor-car is 1 mile in 4 min. 15 sec., how long will it take to do the journey?

(6) A bale of wool weighs 6 cwt. 2 qr. 1 st. How many such bales will weigh $26\frac{1}{2}$ tons?

TABLE OF LENGTH IN THE METRIC SYSTEM.

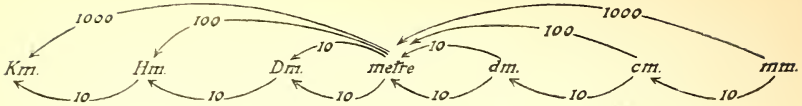


TABLE OF WEIGHT IN THE METRIC SYSTEM.

LONG MEASURE.

12 in. = 1 ft.; 1 in. = $\frac{1}{12}$ ft.
3 ft. = 1 yd.; 1 ft. = $\frac{1}{3}$ yd.
22 yd. = 1 ch.; 1 yd. = $\frac{1}{22}$ ch.
10 ch., or 220 yd. = 1 fur.; 1 ch. = $\frac{1}{10}$ fur.; 1 yd. = $\frac{1}{220}$ fur.
8 fur., or 1760 yd. = 1 mile; 1 fur. = $\frac{1}{8}$ mile; 440 yd. = $\frac{1}{4}$ mile.

AVOIRDUPOIS WEIGHT.

16 oz. = 1 lb.; 1 oz. = $\frac{1}{16}$ lb.; 4 oz. = $\frac{1}{4}$ lb.
14 lb. = 1 st.; 1 lb. = $\frac{1}{14}$ st.; 7 lb. = $\frac{1}{2}$ st.
28 lb., or 2 st. = 1 qr.; 1 lb. = $\frac{1}{28}$ qr.; 1 st. = $\frac{1}{2}$ qr.
4 qr., or 8 st. = 1 cwt.; 1 qr. = $\frac{1}{4}$ cwt.; 1 st. = $\frac{1}{8}$ cwt.
20 cwt. = 1 ton; 1 cwt. = $\frac{1}{20}$ ton.

TIME MEASURE.

60 seconds = 1 minute; 1 second = $\frac{1}{60}$ minute.
60 minutes = 1 hour; 1 minute = $\frac{1}{60}$ hour.
24 hours = 1 day; 1 hour = $\frac{1}{24}$ day.
7 days = 1 week; 1 day = $\frac{1}{7}$ week.
52 weeks, or 365 days = 1 year; 1 week = $\frac{1}{52}$ year; 1 day = $\frac{1}{365}$ year.

CAPACITY MEASURE.

2 pt. = 1 qt.; 1 pt. = $\frac{1}{2}$ qt.
4 qt. = 1 gal.; 1 qt. = $\frac{1}{4}$ gal.
2 gal. = 1 pk.; 1 gal. = $\frac{1}{2}$ pk.
4 pk. = 1 bush.; 1 pk. = $\frac{1}{4}$ bush.
8 bush. = 1 qr.; 1 bush. = $\frac{1}{8}$ qr.

SQUARE MEASURE.

144 sq. in. = 1 sq. ft.
9 sq. ft. = 1 sq. yd.
4840 sq. yd. = 1 acre.

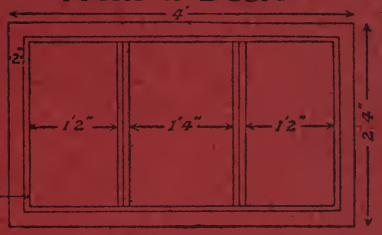
CUBIC MEASURE.

1728 c. in. = 1 c. ft.
27 c. ft. = 1 c. yd.

Classroom Door

Cupboard Door

Front of Desk



Piano — Side view

Desk — Back view

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